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Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

MAKING OUTLINE OF WORK.

AS SOON as the plans and specifications for any new job are received in the office first go through the specifications, noting each and every requirement, using the standard form "Outline of Work" herewith submitted, designated as "Plates II and III."

The form submitted is a standard and is to be used for each and every job, and from practical experience it has been found to cover all working conditions, whether the job is large or small. This form can be used for bridges, buildings, sewers, earth work, railway construction, pavements, sidewalks, and, in fact, every kind of work coming to any contractor. The form is adaptable for all classes of work and the benefits to be obtained from the use thereof are briefly stated as follows:

First. In filling in the general heading, giving the nature of work, where located, owner and architect or engineer, together with the estimate number, we secure an index for permanent record. It is suggested that estimate numbers begin with No. 1 each year, thereby automatically recording the estimating labor for each season. Knowing the number of jobs secured and being careful to distribute the cost of labor in estimating all jobs, we may arrive at a percentage of cost that such estimate bears with relation to the total cost of our general office charges. Preferably, such general office charges are kept separate for calendar years, together with the total volume of business for the corresponding period.

When times are dull and competition "fierce," then estimating will constitute a larger percentage of these charges than when work is plentiful and most of the general office time is spent on actual supervision. This overhead charge, as a whole, naturally fluctuates, as it is considered as a percentage on the total volume of business when making an estimate. Rent, light, heat, etc., together with a certain amount of salaries (which must be maintained regardless of new work) are all independent of the volume of business, so that the percentage to be allowed must really be a matter of good judgment based on extended past experience. The contractor's line of work is not one where he can reasonably count on a steady increase or increment each year, but, instead, where notwithstanding his reputation, he must compete by bidding for each and every job secured. Therefore, a reasonable amount should be added to each estimate, for just such charges, and yet when times are dull no one job can be burdened with the whole charge. An average over several years is, therefore, of more value than to use the actual results for any one period. The cost of estimating should also be determined as a percentage of the total estimated cost of proposed work passing through the office, whether the jobs are or are not secured. Such a record gives data upon which to base a proposition when called upon for a proposal for examination of a promotion project. From an engineering and estimating standpoint, regardless of construction, costs should be kept of surveys, reports, etc., as many times propositions will arise which are to be used for promotion purposes and should be paid for by the parties benefited.

Second. In filling in the secondary heading with reference to date of letting, to whom the bid is to be addressed, amount of certified check, amount of bond, form to be used for bid, amount and manner of payments during progress, beginning and completion of the work and penalty and bonus stipulations we have all the essentials necessary for the submission of a formal proposition, with also due consideration for the financing of the work. The latter point is of great importance, as many times the payments, penalty and bonus must be considered as a part of the cost of the work. For instance, in some cases weekly estimates

CONTRACTING PRACTICE

A. B. C. CONST'R. CO.

OUT-LINE OF WORK

NATURE OF WORK — Reinforced Concrete Bridge — EST. No. 40
WHERE LOCATED — Rocky Creek on Broadway — SHEET, No. 1
OWNER — City — ARCH OR ENG'R — City Engineer — DATE — 5/26/11

DATE OF LETTING — 6/6/11 — ADDRESS TO — City Clerk
AMT. CERTIFIED CHECK — $5000.00 — AMT. BOND — 25% of Bid
FORM FOR BID — Printed Forms fr. City Clerk — PROGRESS PAYMENTS — 85%
BEGIN — At once — COMPLETE — Before 12/31/11 — PENALTY — $50 per day — BONUS — None

ABSTRACT OF SPECIFICATIONS & PLANS

ITEM OF WORK	REFER TO PAGE SPEC.	REFER TO SHEET PLANS	NOTATIONS WITH REGARD TO GENERAL REQUIRMENTS	NOTATIONS OF SPECIAL AND UNUSUAL FEATURES	SEE FIG. & P.
Excavation	7	3	Larger than concrete sizes to provide for.	Depth may be increased	1
			Concrete forms and pumping.	at same unit price.	
2 Piles	7	3	Any sound timber- pointed- 8"@12" in size	Water jet may be required	1
3 Centering	8	1	Not less than 2" lagging- dressed	Removed when permitted	2
4 Concrete	8,9,10	1	Grade A, 1:2:4- 1½" Stone - Arches only	A sack of cement & sheet	2
			" B 1:3:5- 2" stone & gravel- Spandrel	to be taken as one cu. ft.	
			" and retaining walls	machine mixing -	
			" C 1:3:5- 2½" Stone & gravel - piers	Quaking mixture	
			abutments and foundations.	Reinforced - Long	
			" D - 1:1½:2 - ½" gravel - sidewalks	Section - provide forms	
5 Reinforcing steel	10	1	Mechanical Bond- Elastic Limit 50000# Ultimate	Payment only for	3
		1	Strength 80000# Performance for built up fasteners	actual pounds used.	
6 Drainage	11	2	Back piers- 2 W. I. Pipe- Coon with Stone and Sand		4
7 Waterproofing	11	4	Top arches, piers, & Abuts - Plastic - 1:3- 2" thick	Kreps Coat of Medusa	4
			Abutments & Retaining Walls - 1:3 - ½" thick	or equal.	
8 Filling	11	4	Between spandrels to sub grade - earth & gravel	Compacted	4
9 Conduits	11	4	Conduit tops under sidewalks		5
10 Sidewalks	11,12	4		See spec. of City	5
11 Pavement	12	4	Creosoted Blocks	" " " "	5
12 Approaches	12	5	Separate from bridge proper	Same spec. as to material	6
13 Old Brdg	12	2	Excess to Contractor - Debris hauled away		1
			Piers removed to 3' below low water	No salvage provided	
14 Name plates	12	5	One Bronze plate		6
15 Drainage	13	2	Four Conduits - 4-6" Vit. pipe		6
16 Stone	13,14	6	Redfad #1 Colothic - Facing throughout	Sample at Engr. office	7
			and all ornamental work except when	½" Pointing of Meyer	
			granite is specified - general thickness	Pozzolan Cement also	
			facing 8" with 12" bond stones weg 8 cu ft.	used for joints ½ x ¾	
			Wrought work coarse, rubbed finish - full width	1 cem. 1 sand	
			anchors and dowels dipped in hot coal tar	Colorhealed dowels	
			Covering & plows and slips -	Submit plaster model	
			All stone set in Meyers Pozzolan Cement		
			Mortar 1:2		
			Granite, 2 abut and piers from 2' below	Light color from	
			low water to height on drawings	quarry to be selected	
			Approaches to have 14" thick granite curb		
17 Wiring	16	7	Wire for electric lights to 12 Standards	2#8 sub-brid	7
			in Conduits - Bronze Cabinets - Contact	4#-16 C.P. and 12-	
			separate each Standard	32 C.P. lights.	
18 Piping	17	7	Place gas piping in Conduits to Standards		8
19 Covers	17	7	For Conduits & C Mason Bros treads		8
20 Standards	17	7	12 large and 4 small bronze as shown on	Must specify	8
			drawings	thickness of bronze	
Remarks	A		Bids itemized as per pages	← Note	
			2 and 3 of spec - These pages give		
			Engrs. quantities		
	B		Union labor specified	← Note	
	C		Appropriation $70000 with a possible		
			available extra of $5000		

PREPARED BY — D. J. M. 5/26/11 — CHECKED BY — H.B. 5/27/11

PLATE II. CONTRACTING PRACTICE.
Summary of Work Required for Reinforced Concrete Bridge.

are allowed the contractor, and a job of this kind will finance itself. Incidentally it might be remarked that under such terms, or at least not exceeding monthly estimates, the owner secures his work at the minimum of cost. In other work, especially in that for some municipalities, no payments are made until the work is completed and accepted. In a case of this kind arrangements must be made to secure funds to carry the entire cost, and there must be included in the estimate the interest on such funds. As the loaning of money on contract work under these conditions is more speculative than investment, it may be expected that money cannot be secured for less than the usual rate of interest plus a bonus, and in the aggregate these two items will amount to at least 10 to 12 per cent. Under these conditions either the owner or the public pays the bill, provided the bid is properly made.

Sometimes, when the time of completion is the principal element in awarding of the contract, it is wise to include in the cost an allowance for anticipated penalty and set the time of completion at a very early date. On the other hand, if a bonus is offered it is probably advisable to set an early date for completion and make a corresponding increase in the unit cost of the work, looking to the bonus to repay for such extra cost and decreased output caused by overtime and night work.

Third. The third heading covers the abstract of specifications and plans and serves the purpose of itemizing the principal work with a reference to the page of the specifications and the sheet of plans showing such work. The larger space is given to notations with regard to general requirements and a secondary space is allowed for notations of special and unusual features. This idea automatically presents to the eye at a glance an absolute certainty as to whether the specifications and plans are normal or abnormal. The less items that appear in the special column the more certainty in estimating.

By allowing a final column for reference to page of estimate we not only have the reference, but also the opportunity of checking off each item so as to be sure nothing is forgotten. A notation should be made as to who prepares such an outline or abstract of work, and in any case of important work it should be checked. The benefit of such an outline of work is not confined to the suggestions in the foregoing, but also exists in the more systematic, intimate acquaintance with the subject matter gained by the one making the abstract and checking same.

In any case in making a proposal we read the specifications and look over the plans. If at the time of doing this a blank form is used as suggested, we not only guard against omissions, but we gain a more retentive recollection of the requirements, due to the very fact of concentrating our mind to the end of producing the concise condensed abstract. We are also prompted to differentiate between the normal and abnormal requirements. It takes but a few minutes longer to go through a set of plans and specifications this way and the result is far more satisfactory, besides the fact that such abstracts, whether the job is secured or not, are of permanent value as part of the estimate files.

Such an actual summary of work taken from the individual specifications is preferable to any standard printed form, even in the case of the specialist who attempts to list everything on a standard estimate sheet. Human nature will prompt a close adherence to such a form and a slighting of specials pertaining to the job under consideration. Again, since the printed form is arranged in a certain order and very little opportunity given for interpolations and additions, the tendency is to condense items or run specials under miscellaneous or incidentals, which is misleading and makes the estimate obscure.

As an illustration Plate II shows a standard form of this kind covering the work of a reinforced concrete bridge. The original size of the blank used for this work is 8½x14 and the abstract covers one page only. The original specifications for this work covered over 18 pages of the same size, and yet on this abstract are contained all the essentials for estimating, together with references to the proper page of the specifications and plans for any required details. This is one of the cases where the specifications themselves were not indexed or paged, a condition which is more often the case than would be expected. The outline of work supplies the deficiencies of the specifications, at the same time presenting the matter to the contractor in the best possible condensed form for pricing. Especial attention is called to the many notations in the "special and unusual features" column. Most of these items cannot but help have an effect upon the cost because of the lack of certainty as to the meaning of the specifications and as to what may be required by the engineer.

Compare this plate with Plate III, which is the same standard blank, covering a reinforced concrete building. Note how few items appear in the special column. This at once is an indication that the specifications for the building are definite and there is no occasion for a misunderstanding. Both plates II and III

Contracting Practice

A-B-C CONSTR. CO.

OUTLINE OF WORK

NATURE OF WORK 5 Story R. Concrete Bldg. 51X100 — EST. No. 21

WHERE LOCATED Metropolis — SHEET No. 1

OWNER Mercantile Company — ARCH OR ENGR John Doe — DATE 6/1/11.

DATE OF LETTING June 7th — ADDRESS TO Architect.

AMT. CERTIFIED CHECK None — AMT. BOND 75%

FORM FOR BID Architects form — PROGRESS PAYMENTS Monthly.

BEGIN At once — COMPLETE State time — PENALTY Not State BONUS None

ABSTRACT OF SPECIFICATIONS AND PLANS.

ITEMS OF WORK	REFER TO PAGE SPEC.	REFER TO SHEET PLANS	NOTATIONS WITH REGARD TO GENERAL REQUIREMENTS.	NOTATIONS OF SPECIAL AND UNUSUAL FEATURES	SEE PAGE OF EST
Excavation	6	1&2	Investigate conditions		1
Ret. Walls	7	2	Concrete - See plans		1
Underpinning	8	2	Meridian Pl side - question as to depth.		1
Conc. floor	8	3	4" x 3½" at 1:1½		2
Rein Concrete	9	3	1:2:4 stone or gravel		2
Centering	16	3	Removal 2 to 7 days - 1" & 2" lumber		2
Loads	17	4	1st 300# - Others 150# - Roof 40#		2
Cem. finish	21	3	1:2 - 1" thick	Bonding coat" Inside	3
Tile floors and Marble	21	4	Vestibule and Lobby	50¢ per ☐'	3
			Pavonazza Marble - Taco Products Co Milwaukee Wis		4
					4
Mastic Flooring	22	4	First floor store room and offices	Colors as selected	4
Brick	22	5	Walls & piers - Standard hard burned, solid or hollow		5
					5
Face	22	5	Western Brick Co's #730 - Colored Mortar	# 18.00 M.	6
			All brick in Cement mortar 1 part cement & 3 parts lime mortar		6
					7
Stone	23	5	Blue Bedford base blocks Mer Pl & Jackson Place also window sills		7
					7
Partitions	24	6	Tile around elevator & wall first floor		7
			" must end at building		7
			All other and Part House, metal studs & lath		8
					8
Terra Cotta	26	5	Front elevation		8
Plastering	27	6	All metal Partitions, all ceilings, and tile partitions first floor	Color to be selected 2 coats & white coat	8
					9
Carpentry	28-30	6	See plans for Bobbitson Metal Doors	Mill out Bid	9
			Should include hand rail on Stone	Out Bid	9
Roofing	31	7	5 ply pitch		10
Steel work	32	8	Angle Iron Lintels, bolted to Concrete		10
			Angle Iron curb cornice		11
Ornamental Steel	33	8	Brass Thresholds - Pittsburg Am. Light Metal Co.	6 Out Bid	11
			Gas pipe railings, stairways complete		11
			Well hole railings - Treads & Landings		11
			Wrought Iron doors, Pass Elevator - Wire Under		11
			Iron Ox - Fire Escape		12
Painting	36,37	9	See specifications	Out Bid	12
Glass & Glazing		9	" "	" "	13
Dec. Cast Lights	38	9	Luxfer prisms		12
Sheet Metal	39,40	9	See spec. - Skylights - Vents - Flashings	Tile Coat (12")	12
Hardware	40	9	Bungle hardware by Contr. - Finish hdw by Owner		2

PREPARED BY D. I. M. 6/1/11 — CHECKED BY J.H.B. 6/2/11

PLATE III. CONTRACTING PRACTICE.

Summary of Work Required for Reinforced Concrete Building.

are *bona fide* abstracts of actual specifications and are used in the illustrations, although fictitious names and addresses are given, for the reason that only by using such actual cases can we illustrate the adaptability of our system to meet the various ideas and manner of preparation of plans and specifications of the many individuals with whom we must deal as architects and engineers. The above is no criticism of the architect or engineer. The minds of all men do not work the same. Some prepare strong specifications, with an absolute lack of system in indexing, arrangement and definiteness; others are extremely systematic, but produce specifications which are unintelligible or inconsistent.

The next in order is to carefully inspect the plans, comparing with the abstract of specifications. Make such explanatory notes on abstract as are revealed by plans and add to abstract any work on plans not specifically mentioned in specifications.

Compare specifications and plans and note discrepancies and differences with a view of securing an explanation from the architect or engineer, and in lack of same, of so making bid as to keep on the safe side.

Logically the next step before taking off any quantities is to carefully and without haste decide how the job under consideration can be handled and decide just what equipment, how placed and what organization is necessary to execute the work at the least cost.

This first decision is all important. Many times a "guess bid" is made without any particular thought as to how the job is to be handled if the bid is successful. In other words, this all-important decision is deferred until time demonstrates whether there is any use in spending time and thought on such a possibility. Such a method is foolishness. The only way to make an intelligent bid is after proper consideration of organization, equipment and the method of operation, the proposal being made with a confidence that the figures submitted are reasonable and accurate, and with the expectation of being awarded the contract.

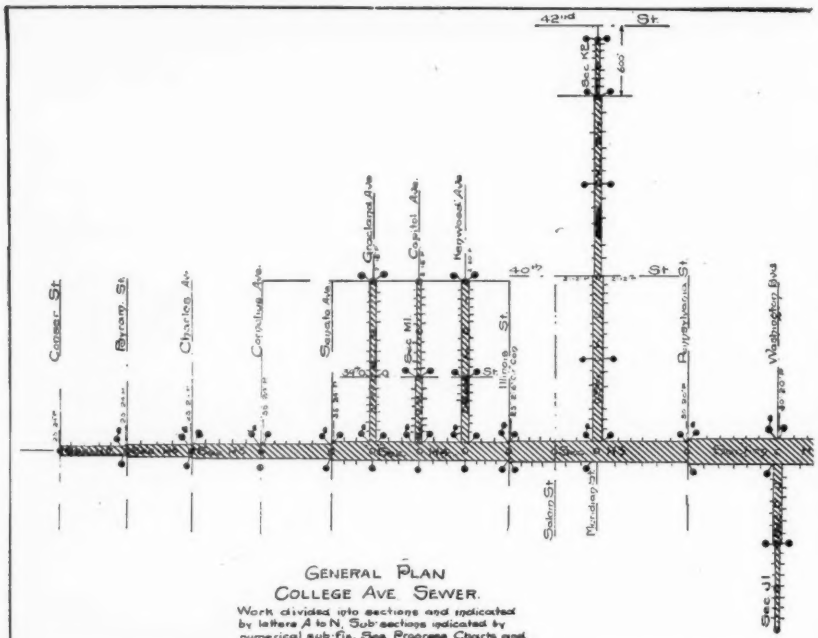
No proposal submitted can result in any satisfaction to either the recipient or the contractor which does not include such a careful examination of the plans and specifications and an inspection of the site of the work. If such a study be given the proposition there will result a plan of operation and a feeling of certainty and promptness in the beginning of the work which will go a long way towards satisfying both parties.

Changes in this plan of preliminary operation may be required, and new ideas and methods promulgated during the actual progress of the contract, but this in no way affects the definite plan which must be the basis of the estimate in the beginning of the work. Any successful proposal requires a definite plan of action and the decision regarding same is better expended at the time of making the estimate than to await the awarding of the contract. Any estimate lacking such a plan of operation will not bear investigation or examination.

Granting, then, that the plan of attack has been decided upon, the decision should be made a matter of record, both by written description and by the preparation of sketch plans showing the general layout of the plant and method of operation. These plans serve as a basis of the amount to be included in the estimate for equipment and the labor of installation, and also as a reminder and guide in the actual moving in on the work, in case the job is secured.

It is true that many times changes for the better are made in such a preliminary plan, but in the majority of cases such changes and improvements are prompted by the study of the proposition at the time the estimate was made. There can be no improvement or better second thought unless at some time previous suggestions have been made. Prepare this preliminary plan in such a form that it may be preserved. If possible, make this plan on the same scale as the general plans of the work. In a great many cases this can be accomplished by making a tracing or sketch with the addition of such notations and additions as are necessary to explain the estimate. However, if the work covers a great many sheets and is thereby complicated, it is best to prepare a new plan on a reduced scale, indicating all the work to be done. A condensed profile will assist the preparation of an estimate far in excess of the value of the time to prepare the same.

It is astonishing in how many cases a really complete set of plans from an engineering and architectural viewpoint, is lacking in this condensed information required for inspection and an intelligent estimate by the construction man. Only this day the author condensed on a sheet of double legal size (17x14 inches) all the essentials in plan, profile and section of a sewer job composing ten sheets 24x36 inches. The sheet thus prepared did not displace these working drawings, but it did furnish a "birdseye view" of the entire job with which the contractor could go into the field, view the site and be properly prepared to make an intelligent estimate from the working drawings. This sheet did not, therefore, displace the working drawings, but did serve a very important connection therewith. This condensed sheet, giving all information,

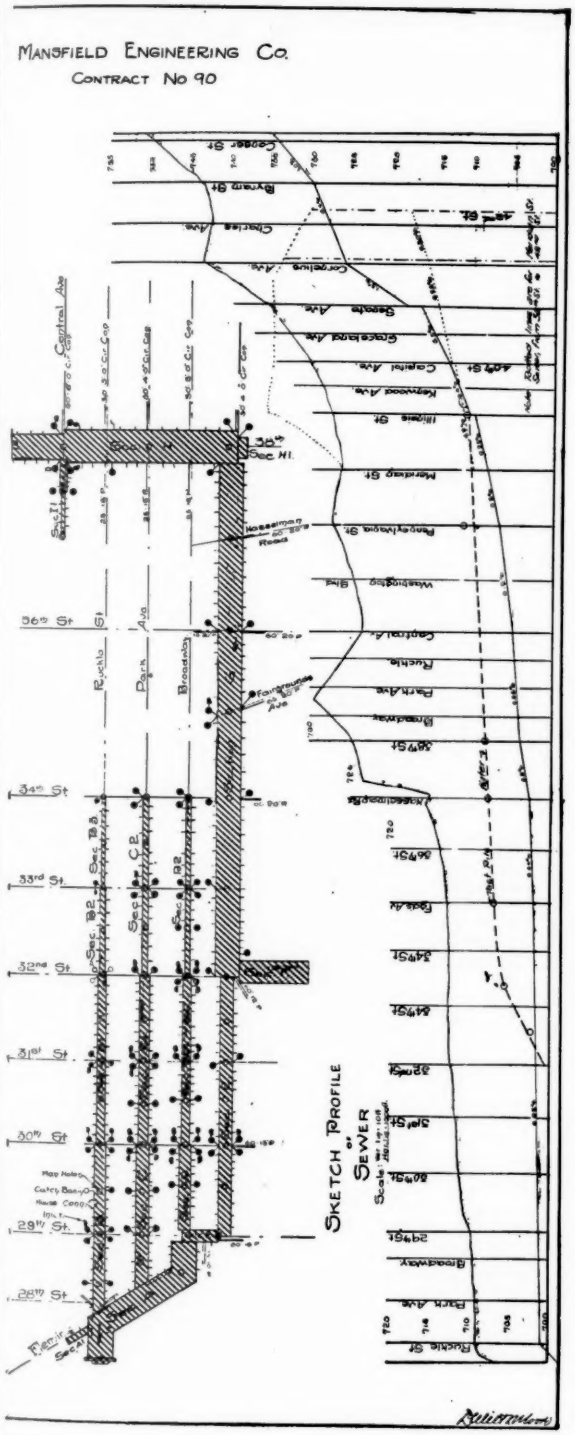


GENERAL PLAN
COLLEGE AVE. SEWER.

Work divided into sections and indicated by letters A to N. Sub-sections indicated by numerical sub-fix. See Progress Charts and system of daily reports, also table below.

Section	Location. In.	Between		Type Cap.	W	Length	Excavation. Cubic Yards. Actual	Surp.	Concrete. Yards per Foot	Total	Type of Mach. Excav.	Concrete	Progress. Rate Beg.	Comp.	Sub Bldg.	Ave. Ft. Day	Forms per	Per Cent	Remarks.
A	Flem.		24th	6·0"		1265	3186	2024	.519	657									
A1	Flem.		Rhle		24	350	434	67											
B	Ruckle	Flem.	30th	5·0"		1310	2402	747	.288	375									
B1		30th	32nd	2·6"		1345	2194	592	.248	334									
B2		32nd	33rd		20	666	1380	126											
B3		33rd	34th		18	643	1147	105											
C	Park.	Flem.	30th	3·0"		1150	2345	656	.288	328									
C1		30th	32nd	2·6"		1340	2235	590	.248	332									
C2		32nd	34th		20	1320	1652	281											
D	Bird's	29th	30th	3·0"		670	1228	382	.283	191									
D1		30th	32nd	2·6"		1350	2500	594	.248	336									
D2		32nd	34th		20	1313	1652	280											
E	College	Bird's	32nd	5·0"		2523	4786		285	643									
F	32nd	Coll.		5·0"		400	1278		.441	176									
G	College	32nd	38th	6·0"		3940	16128	6304	.619	2043									
H	38th	Coll.	Capt.	5·0"		1525	12936	3678	1.048	1389									
H1		Coll.		5·0"		65	416		.441	29									
H2		Capt.	Rapp	6·0"		1325	8745	2120	.519	688									
H3		Rapp	Ill'is	5·0"		1325	6993	1890	.441	584									
H4		Ill'is	Sen.	4·0"		1335	5464	1355	.368	484									
H5		Sen.	Chas.	3·5"		1005	5832	605	.304	306									
H6		Chas.	Byrny.	5·0"		510	1452	241	.288	145									
H7		Byrny.	Canser		24	500	973	95											
I	Capt'l	38th			15	348	540												
I1					12	346	447												
J	Wash. Bd.	38th			18	690	1432	100											
J1					12	700	404												
K	Marid.	38th	40th		20	1550	3965	150											
K1		40th			18	1270	3105	100											
K2			42nd		13	600	866												
L	W'gwood	38th	40th		20	1286	2000	126											
M	Capitol	38th	39th		20	370	1000												
M1		39th	40th		18	715	1115												
N	Gr'land	38th	40th		18	1283	2043	100											

PLATE IV. CONTRACTING
Outline of Work for



PRACTICE.
Sewer Contract.

was prompted by the writer's being called as an expert in construction in litigation over a certain sewer which it was contended was deficient in many respects. During the trial it developed that all the available references were to this multiplicity of sheets, overlapping and drawn square with the sheets, but not with the world. No ordinary man could be expected in reasonable time to ascertain what particular part a witness was referring to in his testimony. The simple sketch map referred to served the purpose of adjusting in the minds of all interested the direction of the sewer, the relation to streets occupied and cross streets and designated without any possible misunderstanding the location of all troubles brought out in the testimony.

The labor spent on a preparation of such a plan is not lost, inasmuch as it forms the beginning of just such a preliminary operation and layout plan mentioned above, and this is not all, for if such a plan is properly prepared it will take its place in the system of progress reports in case the job is secured. For the purpose of estimating the plan may be prepared roughly as a sketch, but in case the proposal is accepted tracings can be made and blue prints secured which will serve to illustrate in the best possible manner the field report.

Plate IV shows a sewer job for which a "Scheme of Operation" was prepared, meaning thereby a condensed plan and profile of the work contemplated. This first rough sketch was used in inspecting the site, in the making of notes and in planning the organization and mode of operation. In this preliminary stage the sketch was not nearly so complete, as shown in the plate, but did answer the needs of the moment. When the job was secured the sketch was completed and traced in a neat and complete shape, as shown, to form the basis of all working thereafter. Additions were made to harmonize with the progress charts, as will be explained in succeeding articles.

It will be noted that the sewer work, "Plate IV," is cut up into 34 sections for the purpose of progress charts, reports and cost analysis. By a reference to the table in the left-hand corner the need of such a method is suggested not only for this actual job, but for all work.

As an illustration: Section A is a six-foot circular concrete sewer in an average cut of eight feet. Section H is an eight-foot circular concrete sewer in a cut of twenty-four feet. Both of these sections are a part of the same sewer system, but certainly it is not to be expected that either the cost of excavation or concrete will be the same or even approximately so. Any average over the whole job, including these sections and the others of

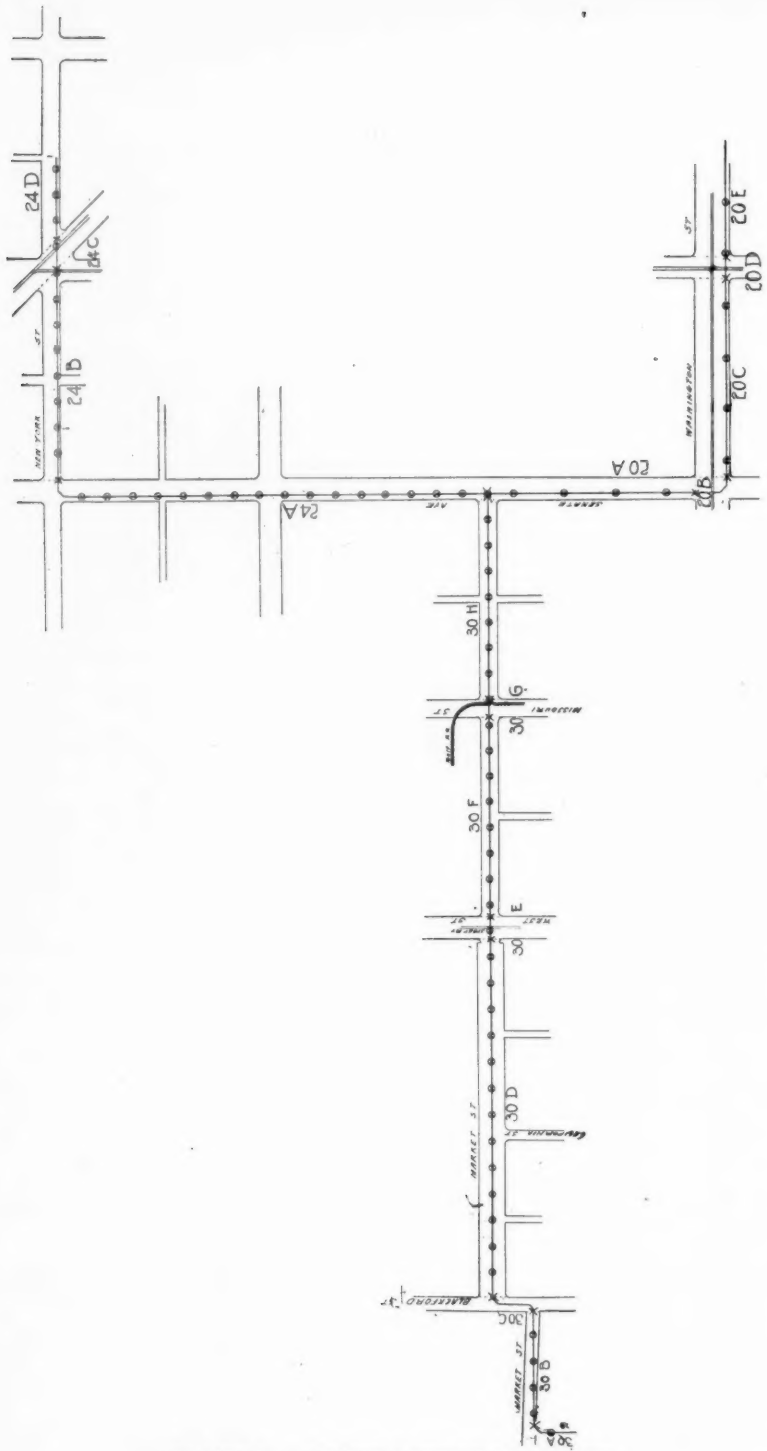


PLATE V. CONTRACTING PRACTICE.
Layout of Sections on Reinforced Concrete Conduit.

intermediate sizes and depths, including pipe sewers, would be misleading for future reference and estimates. Within the limits of this job are contained a great number of sizes of sewer, both concrete and pipe, to be constructed at various depths—sometimes the same size and construction at different depths. As an illustration: Sction A calls for an average cut of eight feet, requiring only occasional shoring of banks and no solid sheeting. Section H2 calls for a twenty-one-foot cut, requiring solid sheeting in two sections of approximately twelve feet each. While the size of sewer is the same, it is not to be expected that the cost of excavation can be the same. Neither will the cost of the concrete be the same, as the rate of progress directly affects this cost.

Again, take Section H, an eight-foot concrete sewer, with twelve-inch walls, requiring a trench of a bottom width of ten feet. Compare this with Section K of practically the same depth but only a twenty-inch pipe, requiring a bottom width of trench of, say, three feet. The first section involves a large yardage per lineal foot and the latter a small yardage, yet practically the same amount of sheeting lumber and labor for placing and drawing same is required. Can the yardage labor cost be the same? No average cost of labor is applicable to any one section, therefore to gain an intelligent record for future use where the sizes and depths may occur in different propositions, it is necessary to divide the work into sections and so keep the costs. Other things than mentioned make the division by sections the most important of all stipulations as to estimate, construction and analysis.

The same character of work without any large variation of quantities may be constructed under absolutely different conditions within the limits of the same work.

Plate V shows a sketch condition of this kind. This work consisted of a reinforced concrete conduit in the downtown streets of a large city. It will be noted that the job is divided into sixteen sections, although there are only three sizes of conduits and the depth of excavation is really uniform. In this case the prefix numerals in each section indicate the size of pipe in such conduit. Section 24-B cannot be compared with Section 24-C, because the latter work is complicated by a street crossing, involving a diverging double track trunk line street railway, requiring tunneling under four tracks and special track work.

The same conditions apply to all work, bridges, buildings and what not, and later a considerable and more analytical study will be given this idea, which, as before mentioned, is the key to all successful analysis, being even more important than any system of cost recording, cost keeping or any form of blanks used.

Averages are all right when properly prepared, but "guess" averages are dangerous and especially so when they are based on so-called cost records, which cover a whole job, without a recognition of this point of sectional division.

Lump sum unit costs are more valuable when proper consideration is given to sectional division than are the most exact itemized unit costs when no attempt is made to segregate. The next article will take up the question of "Itemized Quantity Estimate," with notes on short cuts in estimating.

Steel and Cast Iron Pipe.*

By Allen Hazen, Consulting Engineer, New York City.

THAT which follows relates only to large mains, which I shall define provisionally as mains 36 inches in diameter and larger. In the early developments of the water works business there was but little use for such pipes. So far as they were used, cast iron was the material employed.

Penstocks for water power were among the most frequent examples of large pipe lines at an early date, and for these riveted wrought iron, protected by paint, red lead or other coatings early came into use; the same material was used in water works service occasionally, sometimes because it could be obtained cheaply, at other times because a reliable material was wanted for difficult service.

About twenty years ago steel plates became available in large sizes and at comparatively low prices, and these at once largely replaced wrought iron for such pipes. Pipes made from steel plates had advantages and soon found extended application in the construction of the large water mains that were then demanded in

*A paper before the American Water Works Association.

increasing numbers to meet the needs of growing populations and the increased per capita use of water.

From that time to the present the relative merits of cast iron and steel for large water pipes have been discussed. Much has been said upon both sides. The author will not attempt to enumerate all the arguments that have been used, but only to present the salient features of the case as they present themselves to him, under the conditions that now exist in the northeastern states.

Steel costs more per pound than cast iron, but it is stronger and in some respects more reliable. A steel pipe a quarter of an inch thick may be, and often is, stronger than a cast iron pipe an inch thick, and is commonly cheaper. When steel has replaced cast iron in pipe it has simply done what steel has done in a hundred other directions, in buildings, in machinery, and wherever a higher form of metal has advantages more than commensurate with its increased cost.

In the past a comparison of the two materials for large pipe lines has often rested upon a consideration of the relative durabilities, real or supposed, taken in connection with the relative costs. The steel pipe has been assumed to be less durable, because the metal was thinner and would rust through quicker. But it was much cheaper. For instance, at Springfield, for twelve miles of 42-inch pipe for which competitive bids for steel and cast iron pipe were obtained in 1908, the relative costs were in the ratio of 2 for steel to 3 for cast iron. Cast iron would have cost $600,000. It was actually laid in steel at a cost of $400,000. This ratio probably is not far out for the approximate relative costs of the two materials for large pipes under considerable pressures under the conditions that have ruled in the last few years.

The matter has frequently been presented in this way: The money saved by using steel pipe in a certain case, amounting, let us say, to one-third of what would be the cost of a cast iron pipe line, or 50 per cent. of the cost of the steel pipe line, if put at interest at prevailing rates, would amount to enough to lay a new line of steel pipe at the expiration of some arbitrary period for which it is assumed that the steel pipe will last. The period assumed in making this calculation has seldom been less than twenty-five years or more than forty years. In many cases this calculation has been made and the steel pipe has been put in with the belief that it was better business to use it, even though it rusted through and ceased to be serviceable at the end of the relatively short period assumed for its life.

Large pipes, as defined in this paper, are most frequently used in the supply pipes of a water works system, and less frequently in the distribution, and in such supply mains other conditions than the wearing out or loss of strength of the metal commonly limit the useful life of the pipe.

With both cast iron and steel pipes there is a continuous decrease in carrying capacity occasioned by the roughening of the interior surface, principally due to tuberculation. This roughening is not associated with any appreciable reduction in strength, but it does practically reduce the amount of water that can be carried. On the other hand, the amount of water that has to be carried normally increases steadily with increasing population. Reduction in pipe capacity and increase in demand limit the time that a given pipe will by itself perform the functions for which it was laid, and when, because of these, it ceases to be able to perform its work, another line must be laid to help it out. When this occurs the first line may be considered to have lost a part of its value, and it may then be worth only the difference between what it would cost to lay a new main to supply the whole service and to lay a new main to supply the service in connection with it. This will commonly be only a fraction of first cost. Much of the value is then gone, although the pipe may be physically sound.

These practical considerations in most cases limit the full useful life of steel and cast iron pipe in supply mains of growing cities to periods below the term during which the shell is sound.

The oldest steel pipe lines now in use are about twenty years old. They are still in good condition. Little has been spent upon them for repairs, and there is every prospect that they will continue in useful service for a long time. Curiously it is some of the more recently laid lines that have given most trouble from deterioration.

The weakness of a well-made steel pipe is its liability to perforation. The experience of the last years has emphasized this, and recognition of a weakness is the first step in correcting it.

Perforations of steel pipe are caused in two ways:

1. Mechanically. The escape of a small quantity of water through an accidental opening (at a high velocity because the pressure in the pipe is great) results in eddy action on the outside of the pipe, which gathers grains of sand and brings them forcibly against the outside of the pipe, and in a comparatively short time cuts the steel and makes a perforation of sufficient size to be an important leak. The process of perforating a steel pipe in this manner is a rapid one

after it starts. If the pipe is left with considerable leaks, then enlargements may be expected to occur in short order.

The remedy is to test the pipe under more than full pressure before the trench is back-filled, to caulk it tight and to make the joints so substantial that there will not be chance for openings to occur. This may be done by careful workmanship and good inspection; it has been done with most of the lines of steel pipe that have been laid. Failure to do it in some cases has brought its own lesson promptly. Looking at the matter broadly, there is comparatively little trouble in preventing such mechanical perforations, and little trouble is to be expected from them as the years go by.

2. Chemically. It is a curious property of steel plates that corrosion is not equally distributed, but is concentrated in small places. Once in a while there is a place which, for some reason, corrodes more rapidly than the rest of the plate, and where finally the steel will be eaten entirely through, making an opening which allows the escape of water. There is clearly some imperfection in the steel plate which allows the corrosion to take place, which finally results in perforation, while 99 per cent. of the surface of the plate remains entirely free from deep corrosion.

The matter is not an easy one to investigate, because when the perforation becomes apparent, whatever there may have been in the original plate to start the corrosion has been entirely eaten out and it therefore cannot be found.

Pittings and perforations have developed most extensively in some lines of steel pipe that were not among the first to be laid. In one case salt water from the ocean was a contributing cause.

Different pieces of iron and steel behave differently in sea water, but in general they corrode rapidly, and we may well hesitate to use steel pipe where it will be exposed to the action of sea water, or other highly mineralized water. If it must be so used, the greatest care may well be taken to protect the pipe from contact with the water.

The writer believes that in many cases there is a reason for preferring steel to cast iron which is more important than the saving in cost, namely, the greater strength and reliability of steel. This greater reliability is due largely to the fact that steel is malleable, and therefore capable of being bent and deformed by settlement in the trench and movements under external forces without breaking or reduction in strength, whereas corresponding forces acting upon cast iron pipe would break it.

Cast iron pipe, in the past, has been commonly designed with a thickness of wall sufficient to resist, at an assumed tensile strength and with an assumed factor of safety, the internal pressure of the water in the pipe, with a further allowance for water ram, and generally with a further arbitrary addition to the thickness of the walls to cover inequalities in casting.

The actual test and proof of the formulas that have been used in making this calculation is that the pipe designed by them has in general been satisfactory in service, and the percentage of breakage in actual use has been small.

It is to be noted, however, that most of the experience relied upon in reaching this conclusion relates to pipes smaller than 36 inches in diameter. That relating to large cast iron pipes, although considerable, is by no means as great.

It now seems that the forces taken into account in the formula are not the only ones that tend to break and that do break cast iron pipe. In addition there are internal stresses due to the unequal cooling of the casting; there are stresses that grow out of the fact that the pipe is unequally supported along its length and acts as a beam between points of support, and especially there is the weight of the backfill in the trench carried on the top of the pipe and transmitted through the sides of the pipe to the material underneath. The tendency of this load is to break the pipe.

Prof. Talbot, of the University of Illinois, has investigated the amount of stress produced by fill on pipes of cast iron and other materials by embedding them in sand and loading them to the point of destruction, and has recorded amounts of load or fill required to break them under various conditions.

The important matter for us is, that the stresses that result from these other forces are cumulative to a considerable extent with those resulting from the internal pressure of the water in the pipe.

In a paper recently presented to the New England Water Works Association I attempted to analyze some of these stresses. I will not repeat at this time what is there printed; it will suffice to say that the stresses resulting from the load of backfill are important in pipes of large sizes and make a difference in the thickness of walls required. In other words, large cast iron pipe designed by the formulas that have been used are not as strong in proportion as small pipe designed by the same formula.

Practical experience seems to bear this out, for there have been relatively more breaks in large cast iron water pipes than in small ones. Statistics are not easily obtained of sufficient completeness to be of value, but I think almost any water works superintendent, who has had 48-

inch or 60-inch cast iron pipe in his system, or even 42-inch pipe, will support the proposition that the destructive breakage of such pipe has been greater proportionately than with small pipe.

Further, the possibilities of damage with breaks in the large pipes are greater. It is possible in a few minutes to do thousands of dollars worth of damage by one break in a large pipe in a populous district.

The advantage of steel lies largely in the fact that the walls are malleable; the pipe may be deformed by the weight of the material placed upon it, by inequalities in the trench, and by other forces, and the pipe still retain its strength. Although steel pipes have been designed with nominal factors of safety no greater than those used for cast iron pipe, when all the conditions are taken into account the actual factors of safety have been greater. With hundreds of miles of steel pipe in service in the last twenty years, nearly all of it in large sizes, there have been but few recorded breaks, and so far as the author knows, not a single case of a break of a destructive character; no such record can be shown for cast iron pipe.

With cast iron pipe, in case of a breakage the side of a pipe blows out, and all the water that the pipe is capable of carrying is discharged until the reservoir is exhausted or the supply shut off. On the other hand, the few breaks that have occurred with steel pipe have resulted in comparatively small openings which allowed the escape of some water, but not by any means the full discharging capacity of the pipe. In two cases the pipe has broken squarely off, leaving a circular opening all the way around, through which water passed. The ends of the pipe, however, remained intact and nearly in position, and the openings were of limited size and the pipes continued in service until arrangements could be made for repairing them by sleeves.

In another case there was one defective joint that broke under the test pressure that was applied before the pipe was put in service, tearing out and leaving an opening of some size, but this was repaired before the pipe was put in service.

The perforations of steel pipe that have sometimes occurred and that have been much talked about in the last years, resulting from the rusting or other corrosion of the metal and going entirely through the plate in some cases, result in a relatively small leak which does not interfere with the continued operation of the pipe, and which leak can be easily, completely and permanently repaired without shutting the water off.

It is to be noted that such breaks as have occurred in steel pipes most frequently during laying or preliminary testing, and less frequently in lines in actual service, have occurred, as far as the author knows, always where plates or lock bars or some other part was of steel that was relatively hard. The mild steel is the most malleable, and although it has the lowest tensile strength it makes the most reliable pipe. If there is breakage or trouble, look out for hard steel that has escaped the inspector, or that was near the upper limit of tensile strength allowed under the specifications. For the greatest safety use soft steel.

Steel pipe is made, at the present time, in two principal patterns, namely, with double riveted joints and with lock bar joints. The lock bar pipe is believed to be fully equivalent in smoothness to cast iron pipe, and will carry the same amount of water as cast iron pipe of the same size. Double riveted pipe, on the other hand, on account of the projecting rivet heads and the other irregularities of joints, has a greater frictional resistance. To obtain the same carrying capacity double riveted pipe should be 4 per cent. greater in diameter than either the lock bar or cast iron pipe.

The circular joints of both double riveted and lock bar pipe are commonly made in this country by riveting. This makes what is known as continued riveted pipe. With change in temperature the pipe tends to expand or contract, but is held by the earth and prevented from doing so, and the tendency is converted into stresses which tend to stretch or compress the steel, but which with good design never reach objectionable proportions. As these stresses are, in all cases, at right angles to those resulting from the pressure of water in the pipe, their existence does not affect the strength of the pipe directly, although they may tend to bring out any weak points, and accumulating with other stresses they may have been factors in the production of such few breaks as have been noted with steel pipe.

These temperature stresses must be frankly recognized and provided for at every point. Overlooking them may mean disaster. The details of the joints and connections also must be very carefully studied and must be good.

The design of steel pipe has not been standardized in the same way that cast iron pipe has been standardized. More skill is required to reach a good and safe design with it. Fortunately the early lines of steel pipe were designed by able men, and the precedents then established were good. It is for us to see that they are maintained, and that necessary precautions are not omitted.

Pipe 30 inches in diameter can be successfully riveted in the field, although

the space inside is rather small for good workmanship; 36-inch pipe is more easily riveted, and this marks the ordinary minimum limit of steel pipe as now made.

At Springfield, for the river crossing, two lines of 30-inch steel pipe were used. Steel pipe was selected in this case, not because it was cheaper, but because it was believed to be stronger and more reliable for an especially difficult service.

Generally speaking, with increasing size, cast iron pipe increases in cost more rapidly than steel pipe. The saving to be made by using steel pipe as compared with cast iron is relatively small for 36-inch pipe, and would probably disappear with 30-inch pipe under present conditions, increases rapidly for 48-inch and larger pipe. This is true even with the methods of calculating the thickness of wall of cast iron pipe that have been used in the past. When Prof. Talbot's work is taken into account, and the increased thickness logically called for is allowed on the larger sizes of cast iron pipe, the difference will become greater.

There is a limit to the thickness of castings that can be advantageously used. A large pipe with very thick walls is probably relatively less strong and reliable than one with thinner walls, because the internal stresses in the thick casting are greater and there is more likelihood of its going to pieces from its own internal stresses, acting either by themselves or in conjunction with other stresses from external sources that may come upon the pipe.

When all these matters are taken into account, large cast iron pipe for considerable pressures will increase in cost almost as rapidly as the square of the diameter of the pipe. In other words, there will be relatively small saving by using very large lines of cast iron pipe as compared with several lines of smaller diameter.

In our practice in the last years we have seldom considered the use of cast iron pipe more than 36 inches, or at most 42 inches, in diameter. In nearly all cases we have felt that it was better business to use steel pipe where most capacity was required, or otherwise to divide the line.

Sometimes we have surrounded steel pipe with concrete, thereby adding to its stability and durability. The cost has been increased, but not so as to equal that of cast iron pipe.

Methods of Keeping Records of Improvements to Established Water Works Plants.*

By Charles Carroll Brown, Consulting Engineer, Indianapolis, Ind.

THIS is a large subject, too large to cover in one paper, and so this paper will be restricted to the statement of a few of the underlying principles, some suggestions of methods of classifying and recording items and some examples of the practical application of these principles and methods.

The word "improvements" in the title to this paper is intended to cover new construction of extensions and enlargements, replacement of out-grown or out-of-date materials, apparatus, machinery or structures, and repairs and maintenance of existing structures.

My interest in the subject is largely due to the difficulty in the way of determining the value of a plant for purposes of sale or purchase or for determining equitable rates.

The records are naturally classified into records of disbursement, records of the stock pile and records of construction cost.

1. The accompanying standard form of "'Cash Disbursements and Voucher Record" separates the expenditures for construction, general expense and fixed charges, and maintenance and repairs, and would be sufficient for the financial records were it always possible to distribute the items in vouchers at once to the proper columns under the above-named general headings. But some of the new material and apparatus purchased is put into stock and is drawn from as required, so that the distribution of items, if made accurately, must be made when the material is drawn from stock. When accurate records are required, there must, therefore, be some method of taking care of this stock account and making this supplementary distribution before the closing of the books for the annual report.

In a small plant it is possible to determine, with very close approximation to accuracy, the probable destination of each

*A paper before the American Water Works Association.

CASH DISBURSEMENTS

AND VOUCHER RECORD

Line No.	CONSTRUCTION — DISTRIBUTING SYSTEM — STREET MAINS — Pipe	Valves	Hydrants	Tools	Lead, Heat, Incidentals	Specials	Labor	Total	SERVICE CONNECTIONS — Materials	Labor and Incidentals	Meters	Setting		Total	PUMPING SYSTEM — RESERVOIR & STAND PIPES — Materials	Labor and Incidentals	BUILDINGS — Materials	Labor and Incidentals	BOILERS, ENGINES, ETC. — Materials	Labor and Incidentals	Total	Check No.	VOUCHERS — Date 97	Voucher No.	Cr. Ledger Pos.	Amount	To whom issued	Line No.
	Amounts forward from previous page																											
1	192.50																						1/2	43		192.50	Wm J Drummond	1
2		27.50																						44		27.50	Eddy Valve Co	2
3																								45		93	Builders Iron Foundry	3
4							26					3.50											1/3	46		142.50	Geo Thornton Secy	4
5																							1/3	47		5	Bell Telephone Co	5
6																							1/3	48		5	Geo Thornton Secy	6
7											120												1/2	49		120	Thompson Meter Co	7
8											130												1/5	50		130	Hershey Mfg Co	8
9																							1/7	51	21	100	Hyatt Fuel Co	9
10							18					3.50				5			6				1/9	52		143	Geo Thornton Secy	10
11																								53	10	1000	Central Trust Co	11
12																								54		8	Journal Printing Co	12
13																							1/10	55		65	Rumsey & Engineering Co	13
14																												14
	192.50	27.50					44				250	6				5			6							2041.50		

Line No.	GENERAL EXPENSE AND FIXED CHARGES — Salaries and Labor	Office Expense	Stationery and Printing	Taxes	Interest	Misc's	Total	MAINTENANCE AND REPAIRS — PUMPING SYSTEM — FUEL — Qty.	Cost	Supplies	Salaries and Labor	Misc's	Total	RESERVOIRS AND STAND PIPES — Materials	Labor and Incidentals	Total	STREET MAINS — Pipe and Supplies	Valves and Hydrants	Labor and Incidentals	Total	DISTRIBUTING SYSTEM — SERVICE CONNECTIONS — Materials	Labor and Incidentals	Total	METERS — Materials	Labor and Incidentals	Total	BUILDINGS AND GROUNDS — Materials	Labor and Incidentals	Total	REMARKS	Line No.
																		93													1
																															2
																															3
	56										45							6						7						Pay Roll	4
		8																													5
		8																												Postage	6
																															7
																															8
																															9
	56										45				150			10								2				Pay Roll	10
																														J. Ment	11
			5																												12
			65																											Set of Books	13
																															14
	112	16	73								90				150			93	16					7				2			

item in each voucher and to make the distribution in books made according to the accompanying form, where the voucher totals are entered in the right hand column on the left hand page, so that this form is ample and sufficient for such small plants.

In larger plants where a considerable stock account is carried, the distribution must be made later, as stated, and the method of making this distribution and of keeping the records thereof is the subject of this discussion, which will be confined to a few of the items, perhaps enough to show the principles, and give indications of the methods of applying them, that may be devised.

All purchases of materials and apparatus may be carried to a stock account, and all labor on repairs and handling of materials may be charged to the same account and the distribution may be made under the heading of the stock account. This method of keeping the records might almost entirely eliminate the "Construction" section of the accompanying forms, and some accountants may prefer this method of treating the vouchers.

A large proportion of the purchases may be assigned immediately to the proper division, whether "Construction" or "Maintenance and Repairs", and only such portions as go to stock need be charged to the "'Stock" account. Also, the pay rolls and labor accounts can often be so made up that the labor of handling materials and apparatus into and out of the stock piles can be charged accurately to the "'Stock" account. This latter distribution is not always easy to make, for it requires a detailed record of the distribution of time of men, for which few Water Works Superintendents have prepared forms. In such cases arbitrary rules for charging such labor and materials are sometimes made.

The blank columns between the "Vouchers" columns and the "'Construction" columns on the left hand page of the accompanying form may be used for this "Stock" account, using only one column therefor, or using two, one for materials and the other for labor, as may be preferred.

2. A special stock account will then be kept, to which these items will be charged, and whenever anything is taken from stock it can be credited to the stock account and distributed to "Construction" or "'Maintenance and Repairs" in columns with the same headings as those in the "Cash Disbursements and Voucher Record". When the books are closed before the annual report, the stock account can be closed first, and the footings of these columns can be transferred to the corresponding columns in the "Cash Disbursements and Voucher Record." The totals of these columns will then represent the materials, apparatus and labor actually used during the year. If stock began with zero and ended with zero, the sums of the distribution columns would equal the total of the "'Vouchers" column. Ordinarily, however, this balance cannot be made without bringing in the balances from the stock account, and the "Cash Disbursements and Voucher Record" must have a trial balance before the column footings from the "Stock" account are transferred to it. The one or two "Stock" columns in the "Cash Disbursements and Voucher Record" must, of course, be included to produce the balance.

3. An engineer's record of materials and labor used and expended on each job of construction and repairs is very desirable. It can hardly be compared with or closed into the "Cash Disbursements and Voucher Record". Neither can it be directly connected with the "Stock" account, unless that account includes all purchases and all labor on construction and repairs. But the accounts can be so classified that proper balances can be made and the entries and distributions thoroughly checked.

In showing the method of making the records of improvements, it is necessary to consider the "Cash Disbursements and Voucher Record", the "Stock" account and the engineer's records, the latter often being the records of the foreman in charge of the job in smaller plants, in which the Superintendent also acts as the engineer.

I am indebted to a paper on "Pipe System Records" presented to the Indiana Engineering Society by Dow R. Gwinn, Superintendent of the water works at Terre Haute, Ind., and to Mr. Gwinn himself for much of the material presented in exemplification of the operation of the plan above proposed and for most of the forms of record discussed.

For either large or small stock accounts the card system of keeping records will be found most convenient. The following form of card is suggested for keeping account of the material passing through the stock account and not directly to a construction job, the headings being modified from those used by Mr. Gwinn to fit them for use with the record book above shown, 5 by 8 inches being a convenient size:

1st column—Number of Voucher (corresponding to that given in the "Cash Disbursements and Voucher Record"). It may be necessary to enter this number after the date of receipt of the material in stock, if the voucher is entered in the book after the stock is received.

2nd Column—Date of Receipt. This date is the date of receipt of the material in stock and may differ from the date of

Order No. _____ Terre Haute, Ind. June 3, 1910

TERRE HAUTE WATER WORKS CO.

12th Street, from Collett Street, to Indiana Street.

Size of Main 8" Weight per foot 52.1# Made by USCI P&FCO. Addyston Cost, per ton, Pipe $24.70 Specials 2½ Bells Look N

Work Began June 7, 1910 Work Finished June 9, 1910 Water Turned on June 9, 1910

Location of Main

At N.line Collett	21	ft.	2	in.	W	of	E	property line.	Depth from surface of street to top of pipe	4	ft.	8	in.
100'N.N."	"	21	ft.	4	in.	W	of	E	" " " " " " " "	4	ft.	10	in.
200'N.N."	"	21	ft.	3	in.	W	of	E	" " " " " " " "	5	ft.	0	in.
At S.line Indiana	21	ft.	0	in.	W	of	E	" " " " " " " "	4	ft.	6	in.	

Specials

LOCATION	SIZE	MEASUREMENTS
S.E. 12th & Indiana	8 x 6 tee	21 ft. 0 in. W of E property line, and 5 ft. 4 in. S of S property line.
		ft. in. of " " " ft. in. of " "
		ft. in. of " " " ft. in. of " "
		ft. in. of " " " ft. in. of " "

Hydrants

LOCATION	NAME	OPENINGS	SIZE	YEAR MADE	WATER TURNED ON	ORDERED BY CITY OF TERRE HAUTE
S.E.12th & Indiana	Mathews	2 - 2½	4"-5		June 9, 1910	May 24, 1910

Valves

LOCATION	NAME	Size	Looks	Open to R. or L.	Turns to Open	Open or Shut	Well or Box	MEASUREMENTS
S.E.12th & Indiana on Jydt.branch	Eddy NY	6"	W	Right	28	Open	Box	18 ft. 2 in. W of E Prop. line; 5 ft. 4 in. S of S Prop. line
								ft. in. of Prop. line; ft. in. of Prop. line

Length of Pipe

MAINS Size	MAINS No. Feet	HYDRANT BRANCH Size	HYDRANT BRANCH No. Feet	INTERSECTION BRANCHES Size	INTERSECTION BRANCHES No. Feet	TOTAL NUMBER FEET	SERVICE PIPE LAID Houses No.	SERVICE PIPE LAID Long or Short
8"	381'	6"	5'8"					

Summary

Approximate weight of Pipe laid _____ tons . . . . . $ _____

" " Specials used _____ lbs. . . . . _____

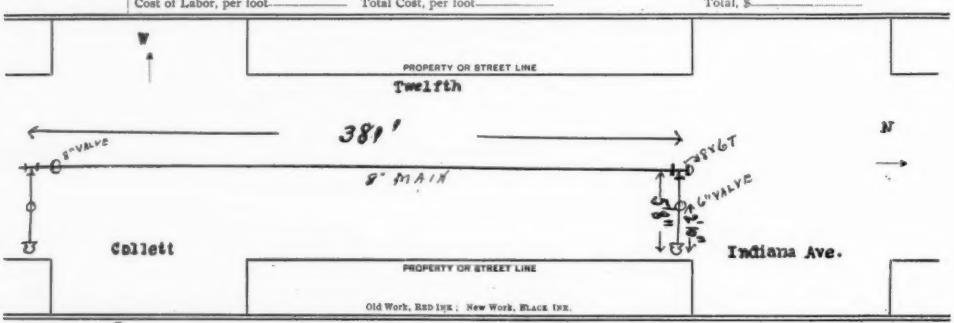
" " Lead used _____ lbs. . . . . _____

Labor, ... _____

Hydrants _____ Valves _____ Drayage . . . . . _____

Hemp _____ Valve Boxes _____ Sundries . . . . . _____

Cost of Labor, per foot _____ Total Cost, per foot _____ Total, $ _____



Approved: Don D. Lyman

Peter Kelly Foreman.

the voucher of corresponding number.

3rd Column—Date of Removal. This date is the date the material is removed from stock and charged to some particular item of construction, renewal or repair. These two date columns might be combined in one, but it is easier to catch the differences in the fourth column if the two date columns are carefully used.

4th Column—This column gives, opposite the voucher number and date of receipt in first and second columns, such information about the materials received as is wanted. Ordinarily this information would be greatly abbreviated, using a standard set of abbreviations, and this column, a wide one, taking at least half to three-quarters of the width of the card, would tell the maker of the material, the place at which it was delivered and, if all the materials purchased pass through the stock account, the statement of the account to which it should be charged, whether new construction, maintenance and repair, or re-construction.

Opposite the date removed, given in the

third column, there would be entered in the fourth column the description of the material taken from stock and the place or job to which delivered and to be charged, and a statement of whether it is construction, maintenance and repair, or re-construction.

5th Column—This, a narrow one, would give the number of pieces, pounds, gallons, etc., received or removed.

The 6th column would give the number in stock, beginning on the first line with the amount brought forward and adding or subtracting the amounts in the 5th column, according to whether they were received into or removed from stock.

If the material, such as pipe, is counted in lengths and paid for in pounds or tons, the 7th and 8th columns may be added, one giving the weights and the other the cost, into or out of stock.

Thus the 5th and 6th columns would give the number of pieces, lengths of pipe, etc., the 7th would give either the total weight of the number given on the same line in the 5th column and the 8th the total cost, or the 7th column might give the average weight and the 8th the price per unit. The latter is probably the more convenient.

One of these cards will be made for each separate item in stock; one for each size of cast iron pipe, for each size of wrought iron pipe, etc.; one for each size and each combination of sizes of crosses, tees, reducers, etc.; one each for lead, leadite, oakum, cement and each other item of supplies.

Mr. Gwinn has a very complete form for reports of engineer or foreman in charge of each job of work, which he styles "Record of Pipe Laying". It covers both sides of a card 10⅛ inches wide by 12½inches long, which is folded in thirds for convenience in carrying by the foreman. Copy of this card is included herewith. As much as possible of the information to be entered on the card is written into it on the typewriter before it is given to the foreman, so that the writing to be done by him can be reduced to a minimum.

In a sample card kindly copied by Mr. Gwinn from an actual office record, the information supplied by the office includes the location, size of main, weight per foot, manufacturer, cost of pipe per ton and of specials per pound, position of bells, year, location of main except actual figures of distance from line noted and depth, location of tees, hydrants and valves except the measurements, and a sketch showing the existing main, names of streets and points of compass. The foreman inserts the measurements, the description of valve, the lengths and sizes of pipe, the date water was turned on, and adds the new work to the sketch, with measurements and sizes. All of this side of the blank is copied on sheets of a loose-leaf record book, and these sheets are filed in a definite order, so that they can be easily found by one familiar with the geography of the city.

The foremen's reports, themselves, are put in special envelopes, with all other data collected with reference to the job, and are filed in the same order as the leaves in the record book.

On the back of the sheet appears under "Remarks", in the sample under description, a detailed description of the street grade as a guide for the excavation, being filled in at the office. The foreman enters on proper lines the number of pounds of lead or leadite used, the number of joints made in each size of pipe, the number of hours of each kind of labor, the charge for hauling by outside party and for company's teams, the number of lengths of pipe used and the number and size of specials used, such as tees, valves, valve boxes, plugs, hydrants, etc.

This record seems to be complete enough so that the office force can check up the stock accounts by comparing these foremen's reports with the cards on which the stock account is kept and with the vouchers for materials and labor. The totals of company's labor can be compared with the pay rolls, for further check. These all make it possible to distribute the items from stock to the proper columns, and to fill any deficiencies in information as to distribution of labor items.

For the plants for which the "Cash Disbursements and Voucher Record" is sufficiently detailed, the summary of the stock account thus checked and amplified by comparison with the reports of construction, can be reduced to a series of items corresponding with the headings of the columns in the "Cash Disbursements and Voucher Record", and at the end of the year the sums of the columns can be taken and these sums transferred to that record and added to its totals, as suggested early in this paper. These totals will then contain all the transactions for the year, although the final sums will not check with the total of the voucher column, unless, as above stated, the stock account stands at the end of the year exactly as it did at the beginning.

There is one item which is not covered by the above description. In case pipe and specials are taken up and returned to stock for future use elsewhere, the foremen's reports should show such facts and the stock account should show the receipt of such material. This material would not appear in the Voucher Record, since nothing has been paid for it, unless possibly the cost of handling it should be charged to it. In any event, the cost

would be small and would reduce the average cost of that class of material in stock. When used, the proper account must be taken of these facts, according to the policy of the managers of the plant.

It may be profitable to discuss the question of policy to some extent. The main purpose of keeping the records described is to determine the actual cost of the construction and maintenance of the plant. It is sometimes difficult to determine whether a certain charge shall be made to construction or to maintenance, and how to manage the credits and charges when a transfer is made from one part of the system to another, whereby one part is

TERRE HAUTE WATER WORKS CO. Filing No.

RECORD OF MAINS, SPECIALS, VALVES AND HYDRANTS

Twelveth Street, from Indiana Street to Collett Street

Size of Main 8" Weight per foot 52.1# Made by U.S.C.I.&P. Co. Addyston Cost per Ton $ 24.10 Cost Specials 40 Bells look N

Ordered by City Nov 24" 1910 Work Started June 7" 1910 Turned on June 9" 1911 Leaded Joints

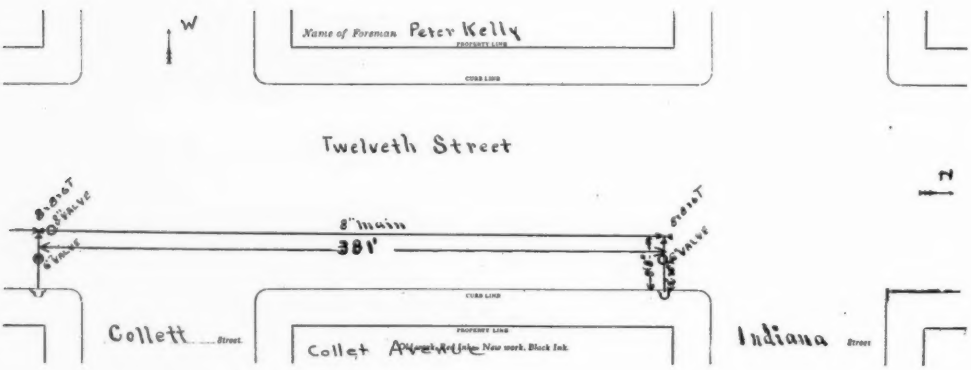
Location of Main		Ft.	In.	Of		Property Line of	SURFACE ST. TO TOP OF PIPE	OTHER MEASUREMENTS AND REMARKS
	At S Line of Indiana St.	21	0	W	E	12" Lt	4' 6"	
	At Center of Block							
	At N Line of Collett St.	21	2	W	E	12" Lt	4'-8"	
	At 100 N.M. "	21	4	W	E	" "	4'-10"	
	At 200 " "	21	8	W	E	" "	5'-0"	

Location of Specials	General Location	Description	Ft.	In.	Of		Property Line of	Ft.	In	Of		Property Line of	REMARKS
	S. E. 12th & Indiana	8X6 Hyd T	21	0	W	E	12" Lt	5	4	S	S	Indiana	

Fire Hydrants	General Location	Name	Size	Diameter Branch Pipe	Openings	Year Made	Water Turned on	Ordered by City	No.	Valve in Branch	REMARKS
	S. E. 12th & Indiana	Matthew	4"-5'	0"	2-2½"		June 9/10	Nov 24th		Valve	Removed from Wabash line

	General Location	Name	Size	Looks	Open to R. or L.	Turns to Open	Well or Box	Ft	In	Of		Property Line of	Ft.	In.	Of		Property Line of
Valves in Mains																	
In Hyd. Branches	S. E. 12th & Indiana	Eddy Mfg	6	W	Right	20	Box	18	2	W	E	12" Lt	5	4	S	S	Indiana

Costs, Etc	MAINS		HYDRANT BRANCHES		INTERSEC. BRANCHES		Exact Number Feet	APPROXIMATE COST								
	Size	No. Feet	Size	No. of Feet	Size	No. of Feet		Pipe	Lead and Yarn	Drag and Sands	Labor per Ft	Total per Ft.	Specials	Hydrants	Valves	Valve Boxes
	8	381	6"	5'-8"												



discontinued or replaced and another part is repaired or an addition is made, using the materials from the discontinued part. This brings in the question of the present value of the plant, through consideration of the depreciation of the part thus used a second time. If the object of keeping the records is kept clearly in mind at all times, these difficulties will be largely removed.

Assuming perfect judgment and supervision in design, construction and maintenance, the actual value of a plant at any date is its first cost, plus the additions and minus its depreciation. The first two items can be determined exactly by means of the system of records described. The latter cannot be determined exactly, and we must make as close approximations thereto as may be possible. We are interested particularly at this moment in the treatment of the re-use of material taken out of a plant and used later in another part thereof, that the actual cost and actual value may be maintained and no fictitious addition or subtraction be made.

For example, an 8x6 cross is put into a line and charged to the cost of that line. It remains in place for ten years and for some good reason is then removed from the line. The labor cost of removal is possibly charged to new construction in connection with a new branch put in, or possibly to maintenance and repairs in case the removal was in connection with the repair of the original line. The cross is then put in stock, where it remains for say three years. It is then put into a new line.

If the total cost of the system is the important consideration, the voucher record will show nothing but the cost of taking out and re-locating the cross, doubtless concealed in a construction or repair pay roll. The cross will be charged to stock and again credited to stock, and charged to the new line without any valuation.

This method of taking care of the case brings in chances for discrepancies, unless considerable care is exercised. Thus, in an inventory taken when the cross was in stock, it might easily be counted at full value if not at original cost. Again, a Superintendent who keeps the full records of construction described above will hardly be satisfied with the report of cost of the new line, because it is less than the actual value by the value of the cross, and so will not compare with the cost of other lines without special explanation.

For the purposes of this record, therefore, the cross should be charged at its value to the new line. This value is not its original cost, but its value after depreciation is charged off, either according to fixed rule or according to actual value as estimated from examination. If depreciation is properly charged off each year, the former method of determining the value will keep the closer to the book value of the plant. So far as the stock account is concerned, there is no difficulty, for the charge in and credit out will balance. There will be less chance for discrepancy in the inventory. To avoid interference with the total value of the plant, it will be necessary to credit the line from which it was removed with the same value that is charged to the new line. This should be done for the benefit of the valuation of the plant as derived from the summary of the costs of the individual lines kept in the records described. For when a line is removed it is no longer of value, and the construction record of the line should show a credit to offset the original cost, or the value at the time of removal if depreciation has been charged off. When part of a line is removed, it is reduced in value by the value of that part of the line.

The form of engineer's or foreman's report is such that this question of depreciation need not be considered in detail in making up that record. The actual pieces, lengths, etc., are there recorded, with dates and such other information as may be valuable in determining actual cost or actual value. These latter computations are made in the office and can be made at leisure or when the occasion demands. More nearly accurate allowance for depreciation can be made if it is made on each section of the work, the rates of depreciation varying with the character of the construction.

It does not seem difficult, therefore to provide in the blanks and books described, with some slight modifications, for entries in about the following order:

1. The voucher will be entered in its proper column in the "Cash Disbursement and Voucher Record."

2. Its items will be distributed to the columns under "Construction," "General Expense and Fixed Charges" and "Maintenance and Repair," all items of materials and cost of handling them to be entered first in columns under "Stock" and then distributed either directly in the "Cash Disbursement and Voucher Record" or in a supplementary "Stock Record" whenever the distribution of stock is actually made to "Construction" or "Maintenance and Repairs."

3. Enter the materials as received on the proper cards in the card record of materials in stock, and credit out as delivered on the job the materials taken out of stock and put into the work. Enter and charge materials taken out of old construction and put into new in the same manner. Give with each entry, in the proper column, the source from which the material is received, its price, total

cost, freight and handling charges and labor being separated if possible, data on which to estimate depreciation, in short, all possible information about the material received; the place to which material is delivered, its cost, handling charge, source, price per unit paid or charged as the case may be, or average cost in case the exact cost of the particular piece of material cannot be exactly identified.

4. Enter on the engineer's or foreman's report of construction all data regarding amount of material used and kind, labor and item to which to charge it, dates, etc., as required on the form presented; also data regarding materials removed and returned to stock in full. Blank space may be left expressly for this or it may be entered under "Remarks," with proper note on the other side of the card.

5. In transferring the foreman's report to the record book all the blanks due to lack of information or greater ease of computation in the office than in the field should be filled in and the actual cost of the job should be worked out completely before records are lost or memory becomes dim.

In the process of transferring the foremen's reports to the record book provided for them, the stock record can be checked, and in part at least the Voucher Record can be checked. The vouchers for the construction or repair will, of course, carry their distribution on the back and can therefore be entered directly in the "Cash Disbursement and Voucher Record."

The distribution of "Stock," if made separately on the supplementary "Stock Record," must, of course, be made in cash, as it is a distribution of vouchers or their equivalent, and these cash figures should check with the figures used in the computation of cost of construction of each job.

The annual summary of the "Stock Record" thus distributed may be transferred to the "Cash Disbursement and Voucher Record" to show the totals for the year if such supplementary record is kept.

This treatment of records makes it possible to draw a more definite line between construction items and maintenance and repair items. Materials are usually easy to charge to one of the two groups, but labor is not so easy, especially when that labor is used in reconstructing a line, part of which is truly new construction and part replacement of old structures worn out or outgrown. If, now, the old material is charged back to stock, at its value at the time, or is written off entirely in case its value is zero, and the new material replacing it is charged at its value, new, the increase in value of the plant due to the replacement is attributed to the line into which it is put, and thus gets into the plant, and the record shows the increase in value. The amount of depreciation allowed on the old material shows the amount of the new construction that should be paid for out of the depreciation fund which every plant should have. The remainder should be paid out of the fund for new construction. If the work done is not in any sense new construction, but is reconstruction or repair of old structures, then the whole net expense would be charged to the depreciation fund. In other words, all new material which increases the first cost of the plant, i. e., adds to its capacity or convenience of operation, should be charged to new construction, and all material which does not so add to the first cost, but simply restores the former ability of the plant to do the duty for which it is designed, should be charged to maintenance and repairs and paid for out of the funds provided for that purpose or to take care of depreciation, as the policy of the company regarding these funds directs.

Labor items are not so readily distributed, and numerous arbitrary rules have been devised to take care of them, for example, to charge the materials to new construction and the labor to maintenance and repairs, on the assumption that this will come near being equitable. If, however, the same principle is applied to labor that is applied to materials, the number of doubtful cases will be greatly reduced.

It is true that most of the new materials supplied in the doubtful cases will belong properly to repairs, but consideration of the principle that what adds to the first value of the plant is new construction and what only restores that first value is repairs, will enable the superintendent to make the distribution of his labor account as easy as that of his material account.

To be sure, the foreman cannot always distribute the time of his men exactly between the two classes of items, but he can give some information about it, and the engineer, if he does it before the matter gets cold, can form a very good judgment of the proportionate distribution of the labor account on the particular job between the two classes of items.

More time is taken in the discussion of these peculiar items, because, while proportionately very small, they are very troublesome. The principle can be applied readily in the ordinary case and is usually properly followed. Only one or two classes of cases are suggested because they are used only as examples of the application of the principle. Each one can make his own decision regarding

each such case which arises, if he will remember the principle and check up his decision to see whether it has been followed throughout.

On back of "Record of Pipe Laying" is the following statement of materials and labor:

Leadite used, 115 pounds.
No. 4-inch joints.
No. 6-inch joints, 4.
No. 8-inch joints, 35.
No. 10-inch joints.
No. — inch joints.
Total hours—
Foreman, 10.
Caulkers, —.
Laborers, 255.
Total, —.

Drayage: 33 pieces 8-in. pipe hauled by transfer company; 9 hours for teams in company's employ.

1 8x8x6 tee.
1 6-in. valve.
2 valve boxes.
1 8-in. valve.
1 8-in. plug.
5 feet 8 inches of 6-in. pipe.
1 Mathews hyd. 4-in., 5 feet.
32 joints 8-in. pipe used.

City Planning in Vienna.

MUCH attention has been given to the city of Vienna by reason of the recent consideration of the question of town planning and the physical improvement of cities. Statement has been made that Vienna is the most perfectly planned city of Europe. Maps, models and photographs showing the arrangement of streets, the grouping of buildings and the general appearance of portions of the city have been shown at the various city planning conferences in support of this statement.

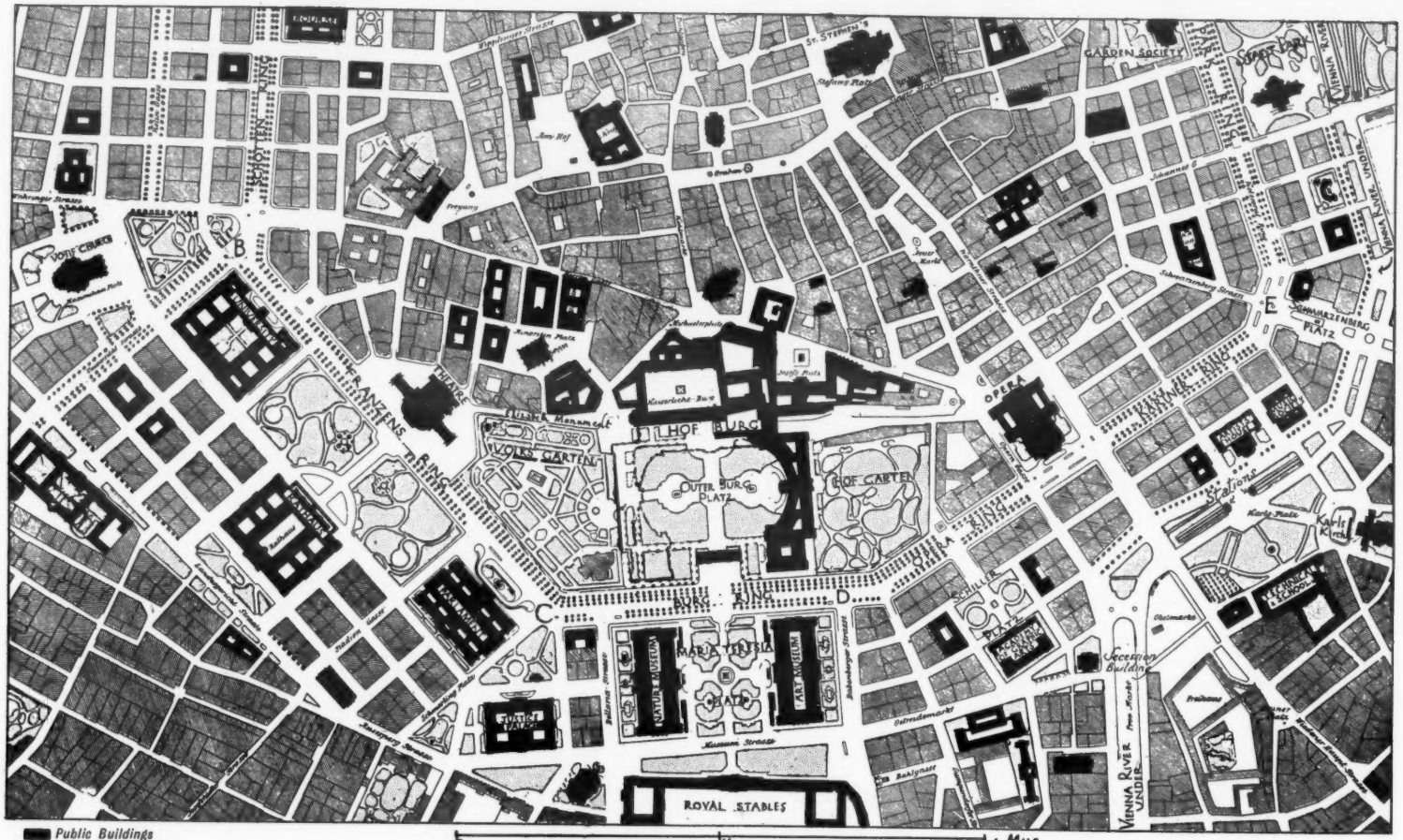
The most noticeable features of the city plan are the three concentric girdles, the inmost of which, known as the Ringstrasse, was formerly occupied by a wall surrounding the inner town. The accompanying diagram shows the western part of the inner town and Ringstrasse. This circular street, with the radial intersecting streets, forming main arteries of traffic, and the grouping of the public buildings about the Hofburg, or Royal Palace, are the points of merit which are claimed for Vienna's city plan.

The Ring is made up of a number of sections bearing distinct names, as follows: The Schotten-Ring, so called from the monastery of Scottish Benedictines situated in the old town near by; the Franzens-Ring, in front of the Royal Theater; the Burg-Ring, in front of the Royal Palace; the Opera-Ring in front of the Royal Opera; the Kaertner-Ring; the Park Ring, in front of Stadt Park, and the Stuben-Ring. The remaining space completing the Ring is occupied by the Franz Joseph Quai, on the Danube canal.

The criticism has been made that the Ringstrasse offers an obstruction to transportation and to the development of the city. Just why the latter should be true is not apparent, unless it is a factor of the question of transportation. And with the number of transverse streets shown, it is evident that transportation may be readily taken care of. However that may be, the opportunity offered for the effective grouping of buildings, and the space allowed for inner town parks and gardens, should compensate for a slight check on transportation.

The grouping of public buildings is an admirable feature of the Vienna plan. All of the group situated with the Franz Joseph Quai as a background are made to center upon the Hofburg and the two imperial museums, which, with the outer Burg Platz and the Maria Theresia Platz, form two inclosed squares. The squares form the central feature of the two symmetrical rings fronting on the Franzens-Ring and the Opera and Kaertner-Rings. The original conception of this plan is due to the German architect, Gottfried Semper, and the building was carried out by Baron Hoolnauer. Photograph 2 shows the Maria Theresia Platz, as seen from the royal stables, with the Art Museum on the right. The formal garden is characteristic of those within the Ringstrasse.

In laying out the other main side of the Ring an attempt has been made to place an important building in the center of each, on the side of the inner town. The placing of the Theater and the Opera centrally on either side of the Hofburg is in accordance with this plan, and is an excellent piece of symmetrical grouping; but owing to their distance apart, this feature cannot be fully appreciated when viewed from the Ring. Photograph 3 shows a portion of the Opera-Ring. As will be noted from the plan (Photograph 1), the wing along the Franzens-Ring has been more developed than the other; the Parliament building, the University and the Rathaus (city building) having been



THE WESTERN PART OF THE INNER TOWN AND RINGSTRASSE

constructed on this first named portion, making it symmetrical upon the Theater as a center. Some idea of the effect of this grouping may be gained by reference to Photograph 4, which shows a view looking towards the Hofburg from the Rathaus across the Franzens-Ring and Volks Garden. The intervening space between the Rathaus and Franzens-Ring is laid out in twin parks, with a central avenue between. The criticism has been made that the large forest trees in these parks tend to obscure the effect of the grouping of the buildings, as viewed from

2. THE MARIA THERESIA PLATZ, VIENNA,
Taken From the Royal Stables.

the ground level. This effect is not noticeable from the photograph shown.

A great deal more intelligent treatment is evident in the wing dominated by the Theater than in that of which the Opera forms the central feature. In the latter, the two important groups formed by the Academy of Graphic Arts with the Schiller Platz and the Technical School and the Karls-Kirche have been allowed to become widely separated by blocks of office buildings, so that their effect is entirely lost. The Technical School and Karls-Kirche, facing the Artists' House and the Music Society, form an independent group, the Vienna river, which flows between them, having been covered to form Karls Platz and a garden in front of the Technical School.

The grouping of buildings on other portions of the Ring does not follow any consistent plan, such as characterized those previously mentioned, but it is hoped that in time a more orderly arrangement may be effected.

The base of the Ringstrasse is formed by the Franz Joseph Quai, a portion of which is shown in Photograph 5. It is in the form of an irregular curve, following the line of the Danube canal, and with the convex side towards the Hofburg, except near the Schotten-Ring, where a slight bend in a contrary direction forms a small park. The buildings along the Quai form a fairly level horizontal line, and the banks have been improved after the manner shown by concrete walls. The bridges are by no means remarkable, but are consistent and artistic.

There are, as may be noted, a number of small parks or town gardens within the Ring. These vary from the small patches in front of the Palace of Justice to the wooded park known as Stadt Park. They are in most cases laid out after the formal fashion noted in the photograph of the Maria Theresia Platz, but in some cases they are characterized by the pic-

3. THE OPERA RING, VIENNA.

4. THE FRANZENS-RING, VIENNA.
Looking From the Rathaus Towards the Hof-Burg.

turesque "English manner," with well-grown, unrestricted trees and rich, thick foliage.

The Prater, not shown on the plan, is the true town park of Vienna. It is divided into three parts; the first, known as the Wurstel Prater, contains the milder amusement devices found at our state and county fairs; the second is dominated by the rotunda, erected for the exposition and preserved for exhibition purposes; and the third consists of natural woods and water. Extending through the Prater is a tree-lined drive three miles long, known as the Haupt-allée. Photograph 6 shows the Haupt-allée, or long drive through the Prater, with the walks and parking at either side. A number of other gardens and parks owned by the city or belonging to the royal grounds may be found throughout the city, but, excepting the Prater, they are of value only for their appearance, as they offer no such advantages as are demanded in American parks, namely, shade and plenty of green grass.

The streets are generous in width and well planned, though in some cases wretchedly paved. The accompanying cross-sections show a number of the principal streets. As will be noted, ample space is provided in each case for all classes of traffic. The Ringstrasse is symmetrically laid out, with roadways on either side of the central roadway and separated from it by a tree-lined promenade and riding track. The effective means of screening the sunken railway along the Gurtelstrasse may be noted. The idea of avoiding the unsightly appearance generally noted in street railway appurtenances is shown in Photograph 7, flower baskets having been provided on the trolley standards and an artistic design for the base substituted for the straight, unsightly pole so common in America.

The Stadtbahn, or Metropolitan railway, follows along the canal for five miles. The promenade, which forms a part of the gardens, is immediately over the railway and supported on columns in such a way that one side, towards the canal, is open to provide light and air.

Taken in its entirety, the Vienna plan has much to recommend it to those interested in city planning, though in some cases the carrying out of ideas has been unsuccessful.

7. ORNAMENTED TRAMWAY POLES, VIENNA.

5. THE FRANZ JOSEF QUAY, VIENNA.

6. THE LONG DRIVE THROUGH THE PRATER, VIENNA.

Sewage Disposal with Respect to Offensive Odors.

By George W. Fuller, M. Am. Soc. C. E., New York City.

Odors in the Collecting Sewers.

FOR some thirty years, beginning with the comprehensive report outlining the scientific principles on which European sewers were built, prepared by Mr. Rudolph Hering, at the request of the National Board of Health, it has been known that sewage should be brought to the point of disposal as promptly as possible and with minimum opportunity for putrefaction of stranded materials within the pipes. As knowledge has increased with respect to decomposition of sewage, it has become clearly recognized that additional care should be required in the collection of sewage from the standpoint of guarding against objectionable odors. The principal features requiring attention are as follows:

VENTILATION OF SEWERS.

It is highly important to provide fresh air in the underground channels comprising the collecting pipes of the sewerage system, in order to maintain bacterial processes, as far as possible, on an aerobic basis. Lack of ventilation tends to promote in places a needlessly rapid exhaustion of the oxygen dissolved in the water supply as it is discharged into the sewers, and it is not difficult to find some cases where objectionable odors exist in the collecting sewers themselves. In some instances good ventilation will correct this difficulty. In other instances the fault is a fundamental one in the design of the sewers, and one which ventilation will help, but not cure.

HOUSE CONNECTION TRAPS.

Where plumbing fixtures are provided with suitable traps and with vents leading to a soil pipe that extends above the roof of the building, no good seems to be accomplished by putting a trap on the house connection, through which the sewage passes from the building to the street sewer. Connections that are so trapped frequently have their interior coated with a slimy deposit in which more or less putrefaction is taking place, whereas similar connections that are not trapped have the sides of the pipe comparatively free of deposits and bacterial growths. There are still some differences of opinion in this regard, but it is believed that it would be of material assistance for plumbing codes hereafter to call for untrapped house connections.

NON-SUBSIDING VELOCITIES.

Many of the old sewers, both in this country and abroad, were of such a design that the sewage flowing through them deposit more or less of the suspended matters, including some of a fecal nature. This is probably much more true of the so-called "combined" sewers, which convey both storm water and sanitary sewage, than of the separate sewers, which convey sewage alone. This is noticeable where large storm sewers, in times of rain, discharge very foul matters for some minutes following an increase in flow.

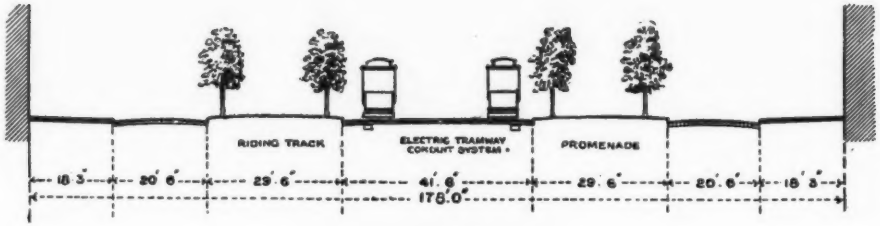
SMOOTH INTERIOR SURFACES.

Where the interior surfaces of the sewers are rough and where projecting masonry allows deposits to be built up in front of it, it is quite possible that in these deposits anaerobic conditions are established in a manner and to an extent that is much more conducive to objectionable odors than is generally considered in this country by those who deal in reasonably well-designed and constructed sewers. The formation of enzymes or soluble fermentation compounds may do much more towards bringing about putrefaction than hitherto realized in this country. German investigators believe this to be true where they have studied old combined sewers.

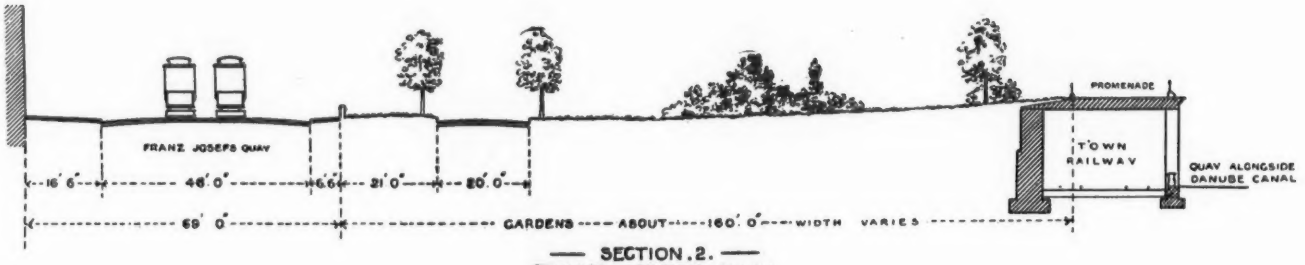
FLUSHING.

First-class sewerage practice calls for the installation of flushing tanks at the head of all sewer lines in order to wash away stranded particles of fecal matter in those portions of the sewer where the ordinary flow is insufficient to maintain a scouring velocity. Such flushing is sometimes done by automatic flush tanks discharging every few hours. From the bateriological standpoint, it would probably suffice to have flushing done once a week during the cold season of the year, and say twice a week in the warmer season of the year.

In the larger sewers it is, of course, not feasible to flush readily from automatic flushing tanks, but it is practicable to keep decomposing organic matter from remaining lodged upon the interior surface of the sewers. This may be done either by hand, with a hose or flush gates or by putting in stop-planks at manholes and allowing sewage to build up in depth until a head is established sufficient to create a scouring velocity.



— SECTION. 1. —
THE RINGSTRASSE



— SECTION. 2. —
FRANZ JOSEFS QUAY

8. SECTIONS OF VIENNA STREETS.

Fire Protection by Gas Engines.

ALMOST important question, which must be considered by the small town, the coast communities and the large or isolated manufacturing plant has reference to fire protection. The matter of expense enters in pretty much every such case. In addition there is the problem of an adequate water supply under sufficiently high pressure. It is possible—and this has been proven in numerous instances—to solve the whole problem by means of a powerful pumping plant operated only when necessity arises. One of the most notable cases is that at Coney Island, the New York pleasure resort.

The buildings at this place have been and are very inflammable. In consequence of the conditions, fire policies were limited to 10 per cent. of the value, and a 5 per cent. rate charged. The location is distant from the general fire system of the Borough of Brooklyn. To maintain an adequate number of fire steamers to cope with the possibilities would have entailed a very heavy expense. An abundance of water was, however, available. First, there was the city supply, and second, the salt water of the immediate vicinity, if such water could be used. The question of power was, of course, important. What was needed was a solution of the power question which would enable a large total of power to become available quickly, and would entail little or no expense in the intervals when not required. This problem was successfully solved by using gas engines and supplying them with the ordinary illuminating gas. A large gas-holder was situated nearby; with this suitable connections were made. Three Nash gas engines of the vertical, three-cylinder, four-cycle type were installed. The cylinders are 13¾ inches in diameter, and the stroke is 16 inches. When these engines are run at 260 revolutions per minute, a horsepower of 175 is developed by each. This is accomplished with gas of but 590 B. t. u. per cubic foot, by using only 17.4 cubic feet per brake-horsepower per hour. The valves of one cylinder in each engine are arranged to permit the use of compressed air to start it off. There are two separate air compressors. One of these has its own small gas engine. There is in addition a series of storage tanks for compressed air, with capacity equal to starting all engines twice. It will be seen from the foregoing that very adequate provision has been made for starting up. In fact, the men in charge do not have to exert themselves at all. The compressed air starts the engine forward, operating through one of the three cylinders. The other two cylinders quickly develop power from the gas—in one or two revolutions, in fact. The engine is put into full operation by gas in 20 seconds. All three engines and the whole plant can be put into full operation in about 2½ minutes. It will thus be seen that we have a source of driving power which becomes available in a very short space of time.

This power equipment drives a very efficient pumping plant. This consists of three triplex, double-acting piston pumps built by the Goulds Manufacturing Co., Seneca Falls, N. Y. Each of these pumps is directly connected to one of the gas engines, and forms with it a water-handling equipment independent of the other pumps. The pistons have a diameter of 12 inches and a stroke of 14 inches. There is a capacity of 40.3 gallons at each revolution of the three-arm crank shaft. As the ordinary angular speed of the crank shaft is 38.5 revolutions per minute, we readily calculate a pumping capacity of 1,551 gallons per minute per pump. Each pump is driven by a pair of pinions which engage with spur gears arranged on the ends of the crank shaft. The gear ratio is 1.5. The suction piping has a diameter of 12 inches; the discharge piping is 10 inches.

Each of the pumps has a by-pass permitting the discharge to pass into the overflow pipe. While the engine is getting under way, the by-pass valve is open; but when the full speed is attained, this valve is gradually closed by an electric motor. The valve is opened or closed in 20 seconds; the electric motor automatically stops when its work of opening or closing the valve is completed. The total capacity of the three pumps is 4,650 gallons per minute. The pressure is 150 pounds per square inch at the pumps. For a hydrant seven-eighths of a mile away the pressure falls only to 140 pounds, when the full capacity of the plant is employed. The area protected totals about 65 acres. There are numerous hydrants so distributed that the whole energy of the pumping plant can be concentrated upon any one block of buildings. These hydrants have 2½-inch hose connections, and are joined to the service mains by 8-inch piping. The full capacity of 4,650 gallons per minute can be developed with 15 to 20 streams.

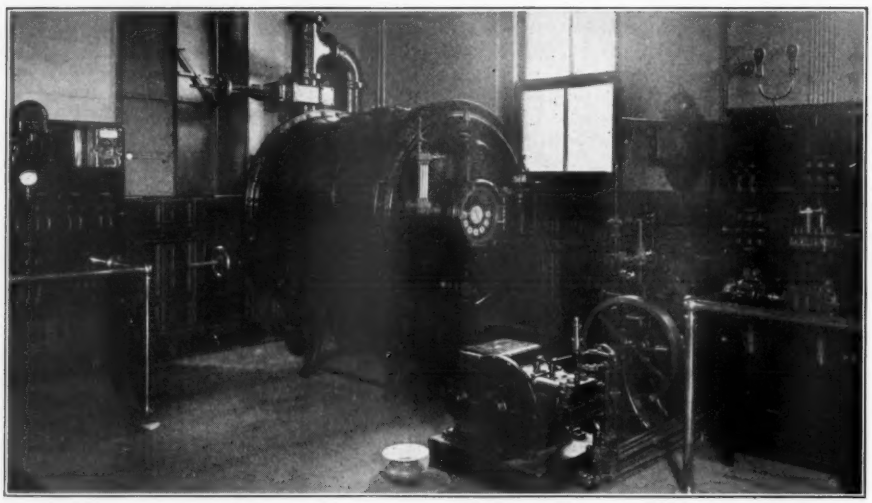
City water is brought into the plant. In addition there is suction connection with an adjacent body of water, known as

Coney Island creek. This water is salt and the supply is inexhaustible. In case the city water should fail the salt water supply could be utilized.

This pumping plant seems to have been admirably conceived. It is economical, as it is operated only when needed. The attendance expense is low. It can be started up with great rapidity and with great certainty. If the city water fails, the Atlantic ocean can be called upon. The whole plant need not be put into operation if the situation does not require it. And the starting up of the plant does not depend upon the muscular strength of the persons at the moment in attendance. A great volume of water per minute is available. Further, the streams are very powerful, so that considerable heights can be reached. A pressure of 140 pounds per square inch is equivalent to that obtainable from an elevated tank or standpipe 320 feet high.

The high pressure pumping plant had a real try-out in 1907 during a serious conflagration. The total capacity of the plant is, as has already been stated, 4,650 gallons per minute, with a pressure of 150 pounds per square inch at the pumps. The 1907 blaze made demands that were just about equal to the capacity. A considerable number of steamers were summoned to the spot, but only a few were really used, according to *The Sun*. The cost for gas for the 16-hour run of the plant amounted to $58.00.

A few weeks ago a great conflagration broke out. The plant has never been increased in capacity by additional units, although the size of the place has grown and the total length of mains has been much extended. It is said that as many as 30 connections were made during this blaze. There could be but one result—a great loss of pressure. Some of the electrical people have seemed to take the absured view that the plant could be expected to furnish any quantity of water at high pressure that an emergency might happen to require. A gas-driven pumping plant cannot be expected to do more in such a situation than an electrically driven one. No reasonable person finds fault with a two-horsepower electric motor that is unable to furnish 4 or 5 horsepower. The manufacturers of the pumps made inquiry of the commissioner's office of the department of water supply, gas and electricity of New York City upon this subject. Deputy Commissioner J. W. F. Bennett replied that the pumps worked satisfactorily during the fire, and that the overdraft "necessarily resulted in the reduction in pressure shown on the charts." The capacity is such as to supply 15 or 18 hose connections with high-pressure streams. To get 30 or 36 such streams is not difficult; it is only necessary to duplicate the plant.



GAS METER AND ENGINE FOR HIGH PRESSURE FIRE SERVICE.

The Width of Street Pavements.*

1. THE INFLUENCE OF SUB-STRUCTURES—By George S. Webster, C. E., Chief Engineer, Philadelphia, Pa.

IN considering the subject of street widths and their subdivisions, the necessity for providing ample space to accommodate the sub-structures needed to meet the requirements of modern city life cannot be overlooked. Underground circulation is as necessary to modern municipal life as surface circulation, and the problems involved in its installation and maintenance have become exceedingly complex and difficult as the demand for such service has increased. Surface traffic may be shifted entirely from off a street temporarily, in cases of emergency, without inflicting any great hardship, but the underground service, once installed, becomes permanent, and any derangement or interference with it ofttimes seriously affects large areas. The great tendency in all our large cities, especially in America, to concentrate business activities at some central location (to create civic centers) has demonstrated the total inadequacy of the street surface to supply space to meet the problems of passenger transportation. It is therefore essential to plan in all our large cities to carry the thousands of people, who daily congregate, for business or pleasure, over railway lines constructed either above or below the street surface. The space required for the foundations to support elevated roads, or the area of the street cross-section necessary for subways, in addition to the sewers, water and gas pipes, telegraph and telephone conduits, pneumatic tubes, pipes for the conveyance of steam, hot water or refrigerating compounds, vaults and tunnels, cannot be found except in streets of considerable width.

The sub-structure congestion occurs not only in the business districts but also along the lines of all main arteries of travel leading from the heart of the city to local centers of manufacturing or business interests. In the central and older portions of the city of Philadelphia many of the streets in the regular system are but 50 feet wide, with a few diagonal avenues 60 feet wide. The widths of these streets are insufficient not only for surface travel but also for the sub-structures which must be placed in them. This congestion is particularly marked at the street intersections. In the replanning of these portions of the city it is found necessary not only to provide for widening existing highways but also to lay out and open additional avenues, and to enlarge intersections to meet the demands for sub-surface structures as well as for surface uses. This increase in street width has been gradually accomplished on Chestnut and Walnut streets, in the business section, by placing the streets upon the official plan with 10 feet greater width and requiring all new buildings to recede to the new line, paying to the owner at the time of reconstruction any damages that may be sustained. By this method the cost is not burdensome to the city. The widths of a number of important diagonal avenues leading through local business centers are being increased in like manner.

In the growth of a modern city the number and character of underground structures is constantly increasing and changing, and it is probable that the future will see the present ones supplemented by others for purposes now scarcely thought of. This ever increasing demand for space under the street surface makes it therefore necessary that the available cross-section be utilized to the best possible advantage. This in a measure can be accomplished in the city of Philadelphia, by grouping the structures as closely together as possible, but a much better method would be by the construction of one or more lines of subservice galleries, of sufficient size to accommodate all future structures, preferably one on each side of the street, close to the curb lines, thus doing away with the usual form of conduit construction and avoiding the necessity of continually opening the street surface and interfering with the proper maintenance of the paved areas. Such galleries might, when old streets are widened or new avenues opened in the built-up portion of the city, be advantageously constructed and maintained by the municipality, and at least a portion of the cost covered by rental charges to public service companies which should be required by law to place their structures in them and to pay a proper rental therefor.

The prevailing custom in many cities of allowing vaults to be constructed under the sidewalks of the street and extending to the surface, results in the occupation of a large percentage of the available cross-section of the street and interferes seriously with the laying of other underground structures. The disadvantage of

* From papers before the Conference on City Planning.

allowing construction of this kind is now being realized in many of our cities and such constructions are wholly prohibited on main thoroughfares. Since 1902 it has been unlawful in Philadelphia to construct or reconstruct any vault under the sidewalks of the streets unless the outside top of the vault be at least four feet below the established grade of the sidewalk over the same, the purpose being to reserve this four feet of space for conduit and tube construction. All persons receiving permits to construct vaults are required to enter into agreement that the city shall in no case be liable for any claim for damages for the reoccupation and use of the whole street or any part thereof to the house line, for public purposes.

In the city of Philadelphia the location of underground structures of every character is determined by a board of highway supervisors composed of the chief officers of the various bureaus of the city government having charge of the municipal underground structures. This board is vested with the full power, not only to grant original locations to companies authorized by law to lay pipes and conduits, but also to direct their removal and relocation whenever the public good demands it. For the purpose of enabling the board to act intelligently upon all applications, a recording and drafting department is maintained where all underground structures are platted and their sizes, depths and distances from the curb or building lines shown upon plans of uniform size drawn to a scale of 20 feet to the inch. Each structure is colored with a conventional tint so that it may be readily followed on the plan. All applicants for permits to locate pipes, conduits or other sub-surface structures are required to obtain plans from the department records showing, as far as practicable, all existing structures in the street, also the location which they desire to occupy. A charge per linear foot is made by the city for such plans and information and the cash receipts are considerably more than necessary to maintain the force in the drafting room and the field inspectors who are sent to see that the locations granted are followed and to systematically make measurements of, and report all structures of every character met with in the excavation. By this means the plans are constantly being checked, and where necessary, corrected. In all cases where electrical conduits are laid by public service corporations, the law requires that one conduit shall be provided and laid at the expense of the company for the use of the city.

2. THE INFLUENCE OF SURFACE CONDITIONS—By George W. Tillson, Consulting Engineer Borough of Brooklyn, N. Y.

THERE is probably no one thing in the make-up of a city that is of as much importance as its streets. This refers to their location and width, as well as their surface treatment.

As this article will deal principally with surfaces, it will be taken for granted that the streets themselves have been properly located. Their surfaces, however, cannot be intelligently considered without giving some attention to width. But before taking this matter up in detail streets must be divided into three groups, namely, wholesale, retail and residential. It is understood, too, that it is often difficult to tell in advance to which group any street may belong and also if it will remain in that group permanently.

Streets have two functions, one to give light and air, and the other to facilitate travel, both pedestrian and vehicular. For the former purpose the width should be varied according to the height of adjacent buildings, and for the latter according to its traffic.

As a rule a wholesale street is not a thoroughfare and consequently a width that will fill local requirements is ordinarily sufficient. For the same reason a wholesale street is used but little for pedestrians, so that a wide sidewalk is not necessary. A wide sidewalk is even a detriment, for, as in most cities goods are taken from the buildings across the walks to the trucks, these walks should be no wider than is absolutely necessary. If then the minimum width of a wholesale street is taken at 60 feet, how this width should be divided as to roadway and sidewalks is the question. In such a case as this it is easier to assume the vehicular than the pedestrian wants, and if the former be satisfied without at the same time interfering with those of the latter, the entire solution ought to be fairly successful.

Only one tier of trucks can be located in front of any building at one time. The large trucks in Manhattan, backed up against the curb, occupy 13½ feet. If the opposite side of the roadway be similarly used, 27 feet in all will be blocked to transient travel on the street. As a general proposition the width of the roadway should be sufficient to allow trucks to load on both sides without impeding the lines of traffic each way. If the roadway be assumed at 40 feet, and 13½ feet be occupied on each side, there would be left a width of 13 feet in the center, which

will be hardly enough for this purpose. It is probable that both sides of the street will not be occupied all the time, especially with the largest size trucks, so that traffic could move fairly well in both directions under these conditions; but if the sidewalk width should be reduced one foot more on each side, making a roadway of 42 feet, there would be no serious obstruction to the traffic. This reasoning is based upon the idea that the entire street width is for the public and is not to be taken up by areas, stoops, railings or obstructions of any kind.

On retail business streets different conditions govern, as both the walks and pavement are used by many transient persons for a short time only, and they are constantly coming and going; but as the vehicles deposit their passengers on the sidewalk, it should, relatively in proportion to the roadway, be wider on a retail than on a wholesale street. Fifth avenue in New York City is the greatest retail street in this country. It is 100 feet wide and until recently has had a 40-foot roadway, with sidewalk spaces 30 feet wide. Areas and stoops, however, were permitted to a width of 15 feet, thus reducing the actual width available to the public to 70 feet. In 1909, between Twenty-fifth and Forty-eighth streets, the curbs were set back 7½ feet on both sides and all encroachments removed to a distance of at least 2½ feet from the building line, causing to be taken down stoops that had been in use for more than fifty years. The entire operation gave a roadway 55 feet wide, with available sidewalk widths of not less than 20 feet each. This new roadway width permits three lines of travel on each side of the street without interference, and the sidewalk width is ample for present needs. The result here has been so satisfactory to every one that the same treatment will be continued as far north as Fifty-eighth street and also applied to many other of the wider streets and avenues where the traffic is congested.

On residential streets the questions that have been discussed are determined more by sentimental than utilitarian principles. So much depends upon whether the street is, or is not, solidly built up and whether the buildings set back of, or on, the property line.. The residential streets of Manhattan are 60 feet wide, with roadways of 30 feet. This leaves sidewalk spaces of 15 feet, but as stoops are allowed to project 5 feet, the width available to the public is only 50 feet. The question immediately arises—if this width is sufficient, why should the city condemn (or expropriate) and pay for a width of 60 feet for public use? A width of 30 feet is sufficient to allow the ordinary vehicle to turn around easily, and as a general proposition is sufficient for a residential street. On short and unimportant streets even this can be reduced without disadvantage.

New York's Economical Refuse Disposal.

Until the appointment of William H. Edwards to the street cleaning department of Greater New York, the disposal of garbage and refuse was both uneconomical and unsanitary. Refuse and ashes were indiscriminately piled in scows and hauled out to sea, or to tide lands which had been bulk-headed and dumped.

The first step taken by Commissioner Edwards was to strictly enforce the separation of refuse into the following divisions: 1. Garbage. 2. Ashes. 3. Rubbish.

The garbage was sent to Barren island, where a private company converted it into commercially valuable products; the rubbish was picked over by Italian laborers, employed by contractors who paid the city thousands of dollars for the privilege, beside donating many more thousands in free labor, as a partial return for the valuables found in land partially submerged or of a marshy composition.

Estimated amounts of garbage removed from boroughs of Manhattan, Bronx and Brooklyn, 5,000,000 cubic yards.

Price paid by city for actual removal to scows, per year.	$ 65,000.00
Paid for removal of dead animals, offal, etc., per year..	50,000.00
Price received for refuse salvage, per year.....	$ 90,000.00
Estimated value of free labor provided by refuse salvage contractor in trimming (picking over) city's scows, per year	50,000.00
Estimated yearly revenue to city through reclamation of land with city refuse and sale of ashes	50,000.00
Total	$190,000.00
Estimated revenue	$190,000.00
Estimated expense	115,000.00
Total estimated net revenue.	$ 75,000.00

The Illumination of Streets and Open Places.

By E. Darrow, Consulting Engineer.

THROUGHOUT the country generally there is a fast arousing sentiment towards securing a better illumination of streets and public places, and in many cities down-town lighting associations have been formed by the merchants, who are carrying to successful completion more effective and artistic street illumination.

It has been realized by the merchants and property-owners that new lighting systems were badly needed, particularly in business districts, and the outcome has been signally successful in several instances.

To the electrical or illuminating engineer the following list shows the more prominent electrical units which are available for exterior service:

1. Carbon filament lamps in clusters or arches.
2. Metalized filament lamps in clusters or arches.
3. Tantalum filament lamps in clusters or arches.
4. Tungsten filament lamps in clusters or arches.
5. Nernst lamps with one to six glowers.
6. Enclosed arcs D. C. and A. C.
7. Magnetite arcs.
8. Flaming arcs—Regenerative arcs.
9. Carbide arcs.
10. Quartz tube.

The efficiency, quality, color and other characteristics vary widely.

The watts per candle are greater in the carbon filament type, viz., 3½ watts per c. p., and least in the quartz tube .25 watts per c. p.

Many of our smaller municipalities have shown a marked preference in business districts for arches with lamps of classes 1, 2, 3, 4, and spaced from 100 to 200 feet apart. A good illustration of this character of service is in evidence at Norfolk, Va.

After a careful investigation and many suggestions as to the design of construction, flat steel arches with a span of 40 feet, a width of 12 inches and a rise of 48 inches, were placed across the street and attached to the iron street railway poles every 100 feet.

Ten series incandescent center space suspension outfits were attached to each arch. The lamps and reflectors alone hang below the arch, and the whole presents a very attractive appearance in daytime. Each arch is lamped with 60-watt 6.6-ampere street series lamps, with automatic cutouts and radial wave reflectors; the neat, yet substantial design, the graceful and symmetrical curve of the arch, have been a source of much favorable comment.

Cities of first grade in the past have depended largely on series arcs for their street illumination.

The characteristics of series arc systems, both D. C. and A. C., need no special comment here.

The practice has been to space these lamps in single units from 300 to 600 feet apart. Four ampere arcs of this type have been in use in Cincinnati for the past eight years, the city's contract calling for lamps which consume 300 watts at the lamp terminal. These lamps are spaced in the downtown districts about every 300 feet.

The illumination from these four ampere arcs has been an absolute failure, and has given Cincinnati the name of being one of the poorest lighted cities in the country.

The four-ampere 300-watt arc is an absolute failure as an illuminant for public places or thoroughfares.

The failure in Cincinnati was also accentuated by the fact that the lamps were hung too close to the ground; viz., about 12 feet, and by the mechanical imperfection of the lamp, which caused excessive outage.

(The new system of ornamental street lights in use in Cincinnati was described in MUNICIPAL ENGINEERING, vol. xl, p. 203.—ED.)

The enclosed arc lamp is essentially an American development ,and its long burning without trimming feature, in spite of decreased efficiency, has made it a popular form of street lamp.

Series enclosed lamps consuming approximately 500 watts and using 6 to 7½ amperes, have been found quite satisfactory and reliable when properly spaced, and hung at proper height.

Metallic flame arcs, employing some mineral element in the carbon electrodes to increase their luminous efficiency are enjoying an increasing use in this country on account of their high efficiency and excellent lighting qualities.

They have the disadvantage of requiring more frequent attention and trimming, and to correct the difficulty practically the same series of remedies have been applied as in the infancy of the old open-arc lamp.

A comparatively new type of lamp, first

brought out in Europe, but also now made in this country, is the regenerative arc lamp. In this lamp the vapors from the impregnated electrodes are carried down and reintroduced into the arc chamber, increasing the luminous efficiency of the flame. Such lamps may be operated for 75 hours without retrimming.

Metallic flame lamps of the magazine type, using one or more metallic electrodes, have been deservedly successful for their long hours of operation, low cost of maintenance, excellent efficiency and good distribution. Late improvements in this type of lamp gives promise of a steadier quality of arc, and an increasing time between trims of at least 200 hours.

Toledo, Ohio, has installed during the past year a large number of these arcs at street intersections, and in the downtown district on the main thoroughfares have erected two-lamp standards every hundred feet or so, and although they have procured a flood of white light, it is overdone, not artistic in any sense, and exceedingly unpleasant to the eye.

St. Louis, Mo., is now installing, through the efforts of its Downtown Lighting Association, a system of street illumination, using magnetic arcs. On Broadway they have adopted a five-lamp standard. The effect is brilliant, but as a permanent installation it seems to the writer in extremely bad taste.

On all other business streets one-light standards are used.

The Broadway system has been grossly overdone, and gives an unpleasant glare. The three-light standards are spaced approximately sixty feet apart, or ten standards (each of three lamps) on every block, making a total of thirty arc lamps to the block.

The other business streets are illuminated by four magnetite arcs at each street intersection and one intermediate lamp on each side midway. This latter arrangement gives six lamps per city block.

The most artistic and effective illumination is the plan adopted by Indianapolis, Ind.; Des Moines, Iowa; Seattle, Wash.; Los Angeles, Cal., etc.

In Indianapolis the main thoroughfare has six standards eighty-four feet apart, each standard having five individual one-hundred-watt tungsten lamps, each enclosed in a light ground glass or thin opalescent outer globe.

Washington street is an extremely wide thoroughfare, yet with this system a newspaper can be read at any point with ease. The illumination is very even, well distributed, and the effect exceedingly pleasing to the eye.

Similar effects have been obtained in the other cities mentioned above.

The carbide arc and the quartz tube are too little known yet to have a definite place assigned to them.

Titanium carbide is the cathode, and placed below an anode of copper, the latter being inactive and not wasting away appreciably. The light is almost pure white with a slight tinge of yellow. It belongs to the flame type, and its efficiency increases with current density and with increasing length of arc. On test a lamp of this character with three amperes, 103 volts and one-inch arc, consumes only 0.228 watts horizontal candle power.

The mean spherical c. p. was 535 and the mean hemispherical c. p. 738.

The efficiency curves show that the titanium carbide arcs are most satisfactorily operated on constant current circuits, hence this lamp should be particularly adaptable to existing street series circuits.

The European quartz tube lamp is heralded as giving a flood of beautiful golden white light faintly tinged with green, and so brilliant that one can read ordinary print 300 feet from this lamp.

This little lamp has a quartz tube about four inches in length and envelopes an illumination of 4000 mean spherical candle power.

The claims of this newcomer are an efficiency of 0.25 per candle, no renewals of electrode, no cleaning of globes and no delicate parts to get out of order. This is almost an ideal specification, but in its present form is not adaptable for interior illumination.

It has a powerful actinic action and in its development of ultra violet rays it is liable to produce burns on the flesh. As an exterior illuminant it seems to be ideal and any harmful qualities disappear when hung 15 or 20 feet from the ground.

The lamp as now manufactured is for direct current only, but could easily be adapted to mercury arc rectifier circuits.

(a) As a resume and final word in this section, the tendency in arc lamps is away from enclosed ones of relative small candle power and low efficiency towards arc lamps of higher candle power such as the magnetite and carbide.

For artistic effects the Luxolabra type seems to have many attractive and exclusive features.

(b) The suspension of arc lamps of the higher candle power should not be less than 20 feet from curb to bottom of lamp.

When there are no trees the position of lamps relative to curb is not so important, but in suburban districts, which are wooded, the only satisfactory solution is the middle of the street. In downtown districts it is almost universal practice now to have the standards and lamps

on curb lines. Height of Luxolabra type 13 feet 6 inches to top of globe.

(c) Spacing of units necessarily varies with the money available in each instance and the effect that is desired.

Business districts vary to extremes. St. Louis, with thirty metallic flame arcs per city block, has probably the maximum illumination, while many cities think they have sufficient light with 1500-watt arcs each 400 feet. A fairly well lighted section would have not less than two arcs at each street intersection and two midway in block.

The spacing of the Luxolabra type of units varies from 60 to 100 feet or from four to eight standards on each side of the street to a block.

(d) Arc lamp systems are lighted on either moonlight schedule or the all-night schedule. The first means approximately 2,100 hours of burning and the second 4,000 hours per annum. The moonlight schedule is gradually becoming obsolete.

It is difficult to make any comparison of costs, as the characteristics of the various systems are manifestly different. Watts per square foot mean nothing if you do not consider quality. Again it is hard to compare cost of glare with illumination.

Perhaps it may be well to give here some of the prices which municipalities and merchants' associations are paying for street service.

Cincinnati—4-ampere, 300-watt enclosed arcs, $60-$72.

Toledo, Ohio—300-watt, Magnetite, $48.

Boston, Mass. — 500-watt, Magnetite, $118.

St. Louis—500-watt, Magnetite, $80 (approx.).

Indianapolis—500-watt, A. C. enclosed, $62.50.

Indianapolis — Luxolabra standards, $1.05 per foot front per annum.

Des Moines, Iowa—Luxolabra standards, $1.58 per foot front per annum.

With the increasing use of powerful arcs there has become a needless distress to the man in the street. When used for street illumination such arcs should be swung high. The time has passed when high candle-powered arcs should be thrust in the faces of pedestrians.

Such glare as in evidence on Broadway, St. Louis, or Summit street, Toledo, is a garish display, and is most unpleasant to the public, and should be regulated. The glaring arc can be, and ought to be, abolished.

Dr. Steinmetz has pointed out in an admirable manner that eye fatigue is a question of the energy imparted to it by the radiations received. Further the blue end of the spectrum possesses much less energy than the red. Also with the greater divergence of color in more recent light sources, and the greater knowledge of the physiological effects of radiation in general, the importance of considering the color of light sources on purely physiological grounds has become a serious matter.

Frosted globes and diffusing reflectors tend to prevent troublesome reflection and mitigate glare.

At the February, 1910, meeting of the Illumination Society of London there was an extended discussion of glare. Although the discussion was somewhat indefinite, there was nevertheless a general and wholesome condemnation of glaring illumination.

In consideration of costs, renewals, upkeeps, etc., it is useless to attempt comparison on basis of charges per lamp of a rated candle power. Open arcs, D. C. arcs enclosed, Magnetite arcs, valued as street illuminants, may vary over 150 per cent.

The National Electric Light Association recommended the selling of illumination rather than energy, but unfortunately we have evolved no principles by which the effective lighting on two streets can be compared on a basis of illumination. A service contract for a particular and specified illuminant, which has been previously tried out, is the only safe way to handle street lighting contracts at present.

It will be noted that the Norfolk, Va., decorative arc lighting for each 400-foot block required 3,000 watts at lamp terminals.

In Cincinnati four 300-watt enclosed arcs to the block, or 1,200 watts at lamp terminals.

In St. Louis Broadway's special illumination shows 30 300-watt metallic flame lamps, or a total of 9,000 watts per block.

In Indianapolis, with its Luxolabra standards twelve to a block, each standard containing 5 100-watt tungsten lamps, represents 6,000 watts of energy.

Thus it will be seen how widely typical installations vary as to quantity and quality.

Under the usual conditions attendant on aerial line construction, with average spacing of lamps, the cost per lamp erected exclusive of station equipment varies from $60 to $100.

In underground districts the construction costs may reach as high as $250 per lamp.

The cost of installing the 667 Magnetite lamps in St. Louis was close to $140,000. The depreciation in this equipment is easily 10 per cent. per annum.

Maintenance costs in the curb-line system of illumination, such as adopted in Des Moines, Seattle and Indianapolis, are about as follows per 1,000 hours of burning, each post five 100-watt tungstens:

(a)	Five lamps	$ 5 00
	Glassware	2 00
	Cleaning and attendance	1 00
	Depreciation	2 00
	500 k. w. h.	5 00
		$15 00
(b)	Maintenance D. C. enclosed arcs:	
	Carbons and trimming	$ 1 20
	Repairs and globes	50
	Depreciation	2 00
	500 K. W. H.	5 00
		$8 70
(c)	Maintenance metallic flame arcs:	
	Trimming	$ 7 50
	Repairs and glassware	2 00
	Depreciation	2 00
	500 k. w. h.	5 00
		$16 50
(d)	Maintenance flaming arcs:	
	Carbon and trimming	$ 9 50
	Repairs and globes	2 00
	Depreciation	2 00
	500 k. w. h.	5 00
		$18 50

The energy required for these various systems of lighting varies from 6 to 60 k. w. per mile roadway.

An ordinary 60-foot roadway has about 315,000 square feet to the mile, and with the American average of 5 to 10 k. w. per mile, this allows a ridiculously low wattage per square foot.

The consummation of energy per square foot per foot candle is about as follows:

Tungsten lighting .....0.3 to 0.5
Enclosed D. C.....0.25 to 0.45
Metallic flame .....0.06 to 0.13

The radius of action for tungsten Luxolabra types is

about .....100 feet
Enclosed arc lamps.....125 feet
Metallic flame .....300 feet

From the above considerations it would appear that due to the combined influence of public sentiment, first costs and maintenance charges, series burning constant metallic flame lighting units are driving all other types of illuminants from the residence and suburban districts of our municipalities. However, there is a strong trend in business sections of our progressive cities to artistic lighting effects, as is evidenced by the many attractive forms of arches and curb-line lighting which have been developed in the past eighteen months.

The enclosed D. C. and A. C. arc is a back number, and considering its few advantages, its wide adoption was remarkable, particularly as it was so inefficient as an illuminant.

Likewise flaming arcs have a somewhat limited field on account of their color element.

A few years ago a lamp-post was simply a thing to hang a lamp on. Today it is considered a factor of municipal enterprise and intelligence, and our Downtown Merchants' Lighting Association has done much to set a new standard for artistic and efficient public lighting.

WIRING FOR ELECTRIC LIGHT.

General Considerations.—For interior installations the tungsten lamp has proved itself superior to all other illuminants, not only making a great reduction in cost of lighting, but, if properly installed, allows a maximum of eye comfort.

The market now affords an ample supply of well-designed and artistic fixtures, which allow the lamp to hang vertically. Correct illumination can only be figured or determined on a basis of the lamps being in a vertical position.

As a second consideration, the proper selection of reflector and shade-holder is important. The extensive, the intensive and focusing types of holophane shades are each designed to give a satisfactory illumination under certain definite conditions, viz., position of outlet, size and height of room, etc.

Third, it is a well-known principle that the direct rays from the filament should not be allowed to strike the eye, and hence care should be taken in selection of the proper shade, together with proper frosting of bowl. Lamps should not be frosted all over, neither be entirely clear.

Fourth, the importance of keeping the glassware and reflecting surfaces clean can not be too strongly emphasized.

Lastly, the mounting height of outlets or fixtures is an important consideration.

All the above considerations must be carefully analyzed by the illuminating engineer, and on these primary factors he must determine the correct wattage lamps for each outlet. The number of watts per square foot of surface to be illuminated depends on type of service, and varies from a minimum in halls of 0.2 watt per square foot to a maximum of 1.5 watts in stores.

Interior Work.—The different methods of wiring which are now approved by the National Board of Fire Underwriters may be stated as follows:

1. Exposed work.
2. Wiring in molding.
3. Wiring concealed.

Class I.—This method of construction has the following advantages to its credit, viz., cheapness, accessibility and durability. This character of work is appropriate only when appearance is not an objection, and also where there is a minimum liability of mechanical disarrangement. Practically this type of wiring is now only used in mills, factories and for heavy feeders.

Class II.—This class of work is used to extend existing circuits in buildings where the initial installation was concealed. Molding should be used on exterior of walls and ceilings where there is danger of mechanical injury, but should not be used in damp places. It has been a popular form, because it is convenient and in appearance an improvement over open work.

Class III.—Embraces (a) wire run in rigid conduits; (b) in flexible metal conduits; and (c) armored cable. Rigid conduit comes in gas pipe sizes, and if unlined can be bent without injury. Flexible conduit of the Greenfield type is having an ever increasing field. Owing to its flexibility it can be used in many places, which prohibit the rigid construction. It is particularly useful for completed buildings. Conduit work costs double the open work and a third more than molding.

Armored cable is likewise used much in completed buildings, where it is undesirable to disturb floors, and has the advantage that it can be fished between floors and partition walls. It is slightly less expensive than conduit construction.

A choice of two-wire or three-wire system is largely dependent on service conditions. If the source of supply is always to be 110 volts, then a two-wire system must of necessity follow, but if 110-220 volts is available or a probability of its being available, then a three-wire system should be provided.

The difference in installation costs is not marked, although theoretically the saving of copper should be quite marked in a three-wire system.

In planning a wiring installation for a building the engineer should gather all data which will affect the wiring system, such as: kind of structure, space available for conductors, source of supply and details affecting cost.

Outlets.—This is a matter which is closely allied to the general subject of illumination, and requires much care and thought. Some of the salient points which go to determine the location of outlets: (1) type of fixture to be used; (2) decorative and architectural effects desired; (3) requirments to suit taste of owner. Having determined the number and character of service for the outlets, the next step is to locate the distributive center or centers. Some of the conditions governing this are: (1) location of isolated plant or service entry to building; (2) accessibility; (3) have centers as near as possible to the risers; (4) there should be a sufficient number of cut-out cabinets so that branch circuits may not be too long; (5) remember the rule that no branch shall have over 660 watts. Having determined the system, the location of outlets and the distribution centers, the branch circuits may now be laid out. In fireproof buildings it is an invariable practice to lay the conduits between the top of the concrete and the rough flooring, notching any sleepers that may cross the path of the conduits.

All peculiarities of construction must be known in advance before laying out the conduit lines, as this many times is the determining factor in circuit layouts.

The maximum allowable loss in a branch circuit is 1 per cent. At this point a plan and elevation of the feeder circuits and risers should be made, the loads calculated and copper figured, so as to give a loss between service connection and distributing centers of not to exceed 1 per cent.

It may be found advisable to relocate the centers in order to keep the total losses within the limits previously determined.

From the earliest days of electric lighting it was a necessity to have a protection device in the various circuits to protect it from overload, short circuits, etc. For this purpose a piece of fusible metal was provided, which was copper-tipped and known as a link fuse. This was superseded to a large extent first by Edison fusible plug cutout, and more recently the cartridge type of enclosed fuse has been developed.

The distribution centers are now equipped with fireproof lined cabinets, having knife or push button switches and cartridge fuses for each branch circuit.

For street lighting systems the type of wiring mostly used is called the series system. Most arc lamps used for street illumination are constant current lamps. This type has held sway because of the simplicity and the saving in copper.

The disadvantages are the high voltage necessary, and the fact that a single open circuit puts 50 to 100 lamps out of service.

In conclusion it may be appropriate to call attention to the increasing importance of artistic effect and structural ornamentation. Lighting today has passed beyond the wavering glimmer of a tallow dip or oil lamp, and should be made an instructive feature in the progress of science and art. Thus far artistic progress in illumination has made little progress in the United States, but of late, particularly in cities west of the Alleghanies, there is a growing disposition to pay more attention to decorative art and architecture, and a creditable line of new art designs in fixtures are now obtainable.—*Michigan Technic.*

EDITORIAL COMMENT

Competition In Public Contracts

COMPETITION IN PUBLIC CONTRACTS.

Major Cassius E. Gillette has had much experience in his work in the Engineer Corps of the U. S. army with the letting of contracts and was for a time active in improving the methods of governing the letting of contracts by the city of Philadelphia. He has had quite a varied and concentrated experience with dishonest contractors and has made a serious study of the methods of controlling them. In a recent paper before the American Society Engineering Contractors he has reported many of his experiences as illustrations of the desirability of devising provisions in the laws of the states which will make such practices difficult, if not impossible. He makes the following suggestions of matters to be embodied in the laws covering public purchases of supplies and public constructions.

1. All expenditures of public money for supplies and construction work in amounts of $100 and more shall be by formal written contracts. Purchases of less than $100 may be by written proposal and written agreement, duly filed.

2. No bid shall be asked until an actual appropriation of funds has been made for the work or supplies, and before bids are asked for public contracts, official itemized estimates of the cost of the proposed work shall be made and permanently filed in the office of the public official who invites the bids.

3. All public contracts involving an estimated cost of $5,000 or more shall be advertised in three local papers having the largest sworn circulation, and in at least one trade journal of suitable type, sufficiently far in advance of the opening of bids to give the most distant bidder in the state a reasonable opportunity to see the notice in time to submit a bid after due investigation.

Contracts for less than $5,000 shall be so advertised that every bidder residing in the municipality (or county) in which the supplies are to be delivered or work done shall have a reasonable chance to see the advertisement or receive the notice in time to submit a proper bid, and every official charged with the duty of purchasing supplies or making contracts must keep in his office lists of all dealers or bidders who request their names to be put upon such lists whenever such work and materials as they specify shall be desired by the official, and notice sent them in ample time to submit bids.

Purchases and contracts involving less than $100 may in emergencies be made by telephone, provided at least three bids be obtained, and the bids and prices be scheduled for public inspection, all the bids and the acceptance to be confirmed in writing.

In case of contracts for yearly supplies to be delivered as needed purchases shall be by single items. The lowest bidder for each item shall be given the contract for that item, provided that if any bidder does not thereby secure items for which the estimate for the year in question or the actual use for the preceding year shall amount to at least $100, such items may be awarded to the bidder who bid the next lowest for each item.

4. Specifications for public contracts shall in all cases comply with the following requirements.

(a) They shall be clear, definite and complete, expressed with words used in their dictionary meaning and showing exactly what is required in the literal use of the words, which literal meaning must be used in carrying out the contract. If in any case questions arise in the execution of the contract that cannot be clearly answered by the specifications, the matter shall be adjusted by arbitration, in which the contractor shall select one arbiter, the official the second, and they two shall choose a third. Provided, the contractor or any citizen or corporation doing business in the state shall have the right to take the matter into the proper court.

The advertisement, instructions to bidders, specifications and contract form must together cover all necessary information to bidders. They must be concise. Unnecessary verbiage and repetitions must be omitted. Everything must be said once, clearly, and once only.

(b) They shall be itemized in full de-

tail, the unit of every kind of material entering into the structure appearing in the schedule of prices bid.

(c) No responsibility for contingencies shall be specifically put upon the contractor.

(d) The specifications shall be so worded and all arrangements and management concerning the bidding shall be such that all bidders shall be bidding upon fair terms for exactly the same structure or the same result, and upon terms of exact equality as to advantages or disadvantages in so far as the official calling for bids can control or embody it in the bid or award.

(e) The terms "discretion of the engineer," "judgment of the engineer" or their equivalents shall not appear in any specification or contract as calling for their exercise after the opening of bids, unless they be accompanied by full explanation in the specifications showing exactly how they will be exercised in the case any of the various contingencies with reference to which they are used shall occur.

(f) No requirement shall appear in the specifications that have a tendency to discourage bidding unless such requirement is manifestly essential to the work or to the public interest.

(g) There shall be no requirement in the specifications or in the management of the bidding that shall require any citizen to disclose the fact that he contemplates bidding or is interested in a coming bidding.

(h) Specifications must be so arranged that in comparing bids only one thing is to be taken into consideration, the total cost of the work.

(i) The specifications and drawing must all be ready for distribution and freely distributed as soon as the advertisement appears. No charge in excess of actual cost shall be demanded for any specifications or drawings accompanying them. They must be sold or furnished free to any one who asks for them without requiring any information from the party asking for them, and they must be returnable at cost after the opening.

(j) No specification shall require the contractor to follow the specifications and at the same time be responsible for accomplishing certain results, or to guarantee the endurance of the work, or to be responsible for the repairs for any time after the completion of the work according to the specifications.

(k) Specifications or instructions to bidders must suggest that every bid should be enclosed in two envelopes, the inner sealed with wax and the outer not showing that a bid is enclosed.

(l) The official estimate shall be printed in the specifications with the information that no award shall be made for an amount greater than the total of the estimates and no supplemental contract increasing the work beyond that limit will be legal. Also that no bid will be accepted in which the price bid on any article is more than 10 per cent. greater than the estimate, and that if in the execution of the contract it be necessary to increase the amount of any item more than 10 per cent. beyond the estimate, the price of such increase shall be determined by arbitration subject to court action, as specified in Sub. Par. (a) above.

5. Every citizen and every corporation doing business in the state shall have the full right to bid on any public contract and have the bid accepted if it is the lowest.

6. Bids shall be opened in public. All bids received must be kept and opened. Bids with erasures or changes in figures that affect the cost of the work must be thrown out. The public shall have the right to inspect the bids at the opening.

7. Whenever bids are advertised for they must be opened at the time mentioned, and an award must be made to the lowest bidder. Otherwise the lowest bidder shall have a legal claim for damages equal to the profits had the contract been executed.

8. Any citizen of the state and any corporation doing business in the state shall have the right of injunction in the proper court to require compliance with this law, and such citizen or corporation shall have the further right to appear as a party in interest in any suit or adjudication between the contractor and the city official whenever the matter of any public contract comes before the court.

9. In the execution of all contracts inspectors duly appointed according to law by the public official shall have full power to see that the specifications are literally carried out and the completion of the work or the delivery of the goods shall be followed by the proper certificate of the inspector that the work and materials have been in accordance with the specifications. This shall relieve the contractor of all further responsibility.

It is believed that few loopholes are left for the devious work of crooked contractors, although the perfection of the system proposed has not been completely tested.

The engineer who studies the provisions proposed and recognizes the conditions which they are expected to cover will see that practically every one of those complained of and to be superseded was originally an excellent provision devised for the purpose of secur-

ing good work, and he will find that he himself has been using many of them, and may still be using them successfully. But each one has been nullified in special cases by the manipulations of dishonest contractors, aided or permitted by dishonest or complaisant officials, until, in such cases as Major Gillette reports, they have become permanently vicious.

This is another instance of the impossibility of legislating men into honesty. Doubtless it will be more difficult for dishonest men to be successful in getting something for nothing under laws containing the provisions proposed, but will it be impossible? Will not the lack of flexibility of the new system more than offset the greater degree of safety?

The writer has found in his own experience that compulsory publicity in every step of the process of letting and carrying out a contract is the most efficient aid in keeping everything clean. And if this provision of publicity is supplemented by an independent investigating committee, which can check the accuracy of the statements made public, the objects sought are obtained quite as satisfactorily and without losing the benefits of the freedom which an honest administration should have.

We know better what specifications should be than we did thirty years ago, and there is even less reason for indefinite specifications now than then. Engineers are more competent and should not have the same opportunities to secure their educations at the expense of the public which they once had. Contracts can be drawn in better form and with more accuracy of statement and definiteness of detail. We should take advantage of all the advance which has been made in this line and which will yet be made. But this is more readily accomplished through the guidance of an expert commission which can give the municipalities of a state the benefit of the advances in the sciences than through the hard and fast provisions of a law which cannot possibly cover all the contingencies that may arise.

This is a most important subject, and Major Gillette's conclusions are presented with the hope that the readers of MUNICIPAL ENGINEERING may be able to add to the discussion which is now under way in the society for which the paper was written and will be carried on in these pages also.

THE QUESTION DEPARTMENT

Disposal of Single House Sewage—Sinking Well Through Sand.

What I desire to know is this: What would you recommend as being now the most desirable and practicable mode of disposing of the sewage from a toilet or bath room in a private residence? That is, would you recommend an open vault used as an outside water closet, a septic tank, or a cesspool? I have had advice from different parties here, and each seems to have a different idea of the matter. One says, to simply dig a hole in the ground, wall it up and let the sewage waste away by percolation; and another says to build a cesspool, like a cistern, and connect the same with a drain pipe leading from the cesspool to some low point or ditch.

If you have the desired information, I will consider it a great favor, if you will advise me, if not, if you can direct me to any person or company who can give the information, I will be greatly obliged.

Our city is now figuring on putting in a municipal water plant, but because of the fact that many of our citizens are skeptical as to the adequacy of our water supply, we are desirious of making a test by sinking a hole 6 or 8 feet in diameter; but the trouble we have run up against is, that when we get down about 30 feet, we strike a bed of sand or gravel from 5 to 6 feet in thickness, and the water at once rises almost to the surface of the ground. Now what we want to do is this; we want to go through this sand, and on down 20 or 30 feet, in order to make a reservoir below the sand, for the reason that other wells that have been sunk around here, and not through the sand, have always gone dry, because, as we believe, there was no reservoir created below the sand.

Now how are we going to get through this sand with twenty or more feet of water to contend with? Of course, we understand that we can make a wooden curb, which will sink down and follow the digging, thereby preventing the sand caving in, provided we can get rid of the water while digging. What would you recommend as the most practical method of accomplishing our purpose in a small place like this, where we have no kind of machinery at hand for disposing of the water?

A. H. F. Z., ———, Iowa.

The outside closet set over a vault or cesspool forms the common privy, which is almost certain to be more or less of a nuisance, and if the water into which wells are driven for private water supplies or for the public supply which is proposed is so near the surface, it will undoubtedly be polluted by the drainage through the earth from the cesspool. It is, therefore, very objectionable from the sanitary point of view.

The septic tank is a cesspool which is water tight and in which the sewage has an opportunity to disintegrate. The liquid in the tank will overflow when the tank is full and must be disposed of. A common way is to lead the overflowing water by a tile drain into porous soil in the garden, where the water which has been partly purified in the tank can seep into the soil near the surface, and be completely purified. The entrance of the house sewer into the tank should be through a pipe dipping below the surface and so baffled that it will disturb the liquid in the tank as little as possible. Many engineers think the garden irrigation is more successful if the overflow from the tank goes into a small chamber with an automatic siphon which discharges whenever the small chamber fills up. An installation similar to this is described in MUNICIPAL ENGINEERING, vol. xxiii, p. 35, and vol. xxxv, p. 244, in articles on methods of domestic sewage disposal. If there is a low point or ditch not too close to a house the effluent from the septic tank can flow into it as, ordinarily, it does not produce odor enough when discharged in this way to spread very far.

As to the water supply, the city will save money by paying for the advice of a competent engineer to come and study the local conditions and make recommendations.

Unless the water is very unusually large in quantity a centrifugal pump will keep it down in the well enough to get in the curb and permit the excavation. If a pump with a capacity of say 500 gallons a minute will not keep the water down the possibilities are that there is water enough for so small a city. Expert engineering advice should be obtained as to the possibility of contamination of the supply if it is sufficient. If a small pump can keep the water down in the test well, no artificial reservoir below the water stratum would have any effect in increasing the supply.

The fact that wells in the sand stratum have gone dry is evidence that it is insufficient as a source of water supply and that it will be necessary to find another water-bearing stratum farther down or at another place. The engineer suggested can test this readily and with reasonable rapidity.

Reference may be made to the "Business Directory," published in each number of MUNICIPAL ENGINEERING for names of competent engineers, under the heading "Civil Engineers," "Consulting Engineers."

Reinforced Concrete Floor.

I want to build a floor to warehouse, 70x100, of reinforced concrete. I would like for you to tell me the size rods and the distance apart and how many supports I would have to have. 28x70 feet on one end is to

store cement. Where can I buy the reinforcement for the floor?

W. L., ———, Mo.

The supports to the floor and the beams carrying the weight on the floor and its load to the support are quite as important as the floor itself. A proper design cannot be made without more information than is given. Designs for floors are furnished by the makers of the reinforcing material, if the necessary information is furnished. Makers of reinforcement are listed in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the headings "Concrete Reinforcing Bars," "Concrete Steel Arch Bridges."

Manufacturers Seeking Change in Location.

We are starting a new Board of Trade here and I am chairman of the Municipal Committee. Can you put us in touch with a magazine giving the names of firms seeking a change in location of business, etc.?

H. K. S., ———, Pa.

Can our readers give any information as to such magazine or a list of such names or individual instances of such firms?

Investment in Small Electric Lighting System.

Could you put me in touch with parties who have capital to invest in an electric lighting system for a small city of 1,500 population? The city may grant a franchise for a lighting system.

H. J. B., ———, I.l.

Can our readers make any suggestions of persons or firms interested in such an investment?

Cost of Macadam and Asphalt Paving.

Will you kindly give me the difference in cost of macadam roads and asphalt streets based on price per square yard.

G. S. N., Middletown, Pa.

Cost of paving varies so much with local conditions that it is not possible to give a definite answer to this question. In MUNICIPAL ENGINEERING, vol. xi., p. 217, will be found some information on the subject, showing variations in cost of macadam from 50 cents to $2.13 a square yard and in asphalt from $1.45 to $3.24, according to the local conditions. The means of these limits are somewhat higher than what may be termed the average costs, but the averages cannot be applied in any particular case, except in a very general way. The article referred to gives references to other articles which explain some of the reasons for the differences in cost.

Cleaning Catch Basins and Sewers by Pump.

We are looking up the matter of sludge removal from sewers and manholes and sediment from catch basins by the use of a small portable gasoline engine pumping outfit or otherwise.

C. H. E., Winnetka, I.l.

The writer knows of no articles upon this particular subject. With reference to cleaning sewers there are several articles in MUNICIPAL ENGINEERING. The more recent articles are the following:

In vol. xl: "An Interesting Test of a Sewer Cleaner," p. 69; "Flushing Street Sewers," p. 218; "The Kuhlman Patent Sewer Cleaning Machine," p. 294; "Sewage Ejectors," p. 300; "Methods and Tools for Sewer Cleaning," giving references to preceding articles on this subject, p. 345; "Official Report of a Test of the Sieben Sewer Cleaner," p. 376; "Commendation for Sieben Sewer Cleaner," p. 463; "The Sieben Sewer Cleaner in Cleveland," p. 538.

An article on "Dumping Catch Basin Refuse in Sewer," in vol. xxxix., p. 204, gives some valuable information.

Unless there is some special reason for taking the sediment out of the sewers before it reaches the outlet, it is ordinarily better to flush it out by means of water introduced under pressure from hose, using some mechanical device for loosening it if necessary.

Some of the sewer cleaning apparatus described in the articles referred to does this and one or two of the sewer cleaners lift the material dredged from the bottom to the street surface, where it must be loaded into wagons and carted away.

The deposits in catch basins and in sewers can not be removed by pumping unless they are stirred up, loosened and mixed with water enough for the pump to carry them. This means water to cart away as well as the deposits, so that it would seem to be less economical to remove such deposits by pumping than by dredging or by shovel, allowing the water to run off through the sewer. As described in one of the articles referred to, the catch basins can be cleaned partly if not wholly by turning water in through hose under hydrant pressure, and thus washing the deposits through into the sewer, but this increases the cost of cleaning sewers and the latter increase may more than offset the saving in removing the deposits from the catch basins by hand.

Our readers are invited to report their experiences in this matter.

Durability of Bitulithic Pavement.

Can you inform me what the average time a bitulithic street pavement lasts in the cities of the United States? How long do they usually last before repairs are necessary?

I. L. H., Baker, Ore.

This question can not be answered directly. Although bitulithic has now been used some ten years as a street pavement, its life has not yet been determined. To be sure there have been a few instances of early disintegration, but there are many pavements which do not give any evidence of material wear, although in use for several years. The amount and character of traffic is also an important factor in determining the life of the pavement. On residence streets where the traffic is light, repairs are seldom necessary, whereas on streets with

heavy traffic, especially if concentrated on particular lines by street car tracks or other special structures, frequent repairs will probably be necessary. In general it may be said that on streets not having the heaviest traffic a well-constructed bitulithic street has a longer life than its present age as a standard pavement, and that this fact also indicates that repairs will be light. Poor materials and construction and neglect and misuse of a pavement will all or any of them decrease the life of a pavement, make the time to first repair short and the repair bill thereafter large.

Books on Asphalt Paving.

Will you kindly give me a list of two or three of the best books, in your judgment, on asphalt paving? What I want more especially is a treatise on asphalt itself, its mixture and composition, and what constitutes a good or bad paving mixture, and why, not too technical in style. Permit me to congratulate you upon the excellent character of your magazine, which I read with much interest and find very helpful.

W. H. A., Bartlesville, Okla.

Reference may be made to MUNICIPAL ENGINEERING, vol. xxxviii, p. 269, for comment on books on asphalt construction including Richardson's "The Modern Asphalt Pavement" ($3); Peckham's "Solid Bitumens" ($5); Tillson's "Pavements and Paving Materials" ($5); Baker's "Roads and Pavements" ($5); Byrne's "Highway Construction" ($5).

Another book giving some excellent information is Hubbard's "Dust Prevention and Road Binders" ($3).

Size of Branch of Sanitary Sewer.

Will you kindly give me your opinion on the following situation? We will very soon begin construction on a piece of sanitary sewer, designed to become a head branch of a separate sanitary system. I have "Staley & Pierson" on the subject and working from their instruction I have specified for 6-inch pipe, which, of course, arouses the prejudice of old "rules of thumb" and wise heads that have put in pipes from infancy for surface and mixed drainage of all kinds, except sanitary and, of course, they know it ought to be anything from 10 to 18 inches or even 24 inches. It is against these and I understand the county surveyor is to be quoted against me, that I have to maintain and keep my credit with the council and your advice to an old reader will be very much appreciated.

The conditions are these: Total length, 1,300 feet; grade, 1 per cent.; patronage, 30 families with a future possibility not exceeding 100 families. Designed to be maintained as strictly separate system for final treatment in disposal plant.

I make out that 6 inches is ample and will carry the light flow better than a larger size and is more easily flushed if that becomes needful. If there are any practical reasons why 8 inches might be better I would be very glad to quote you to that effect.

C. E. V., ———, O.

A 6-inch pipe is ample to carry the sewage from the population you describe. Practically, however, it is found that an 8-inch pipe does not have as many stoppages as a 6-inch pipe when used for the same work. This is probably due to the fact that too large substances coming into the sewer from 4 to 6-inch branches are not as likely to lodge in an 8-inch sewer as in a 6-inch sewer. This practical consideration induces the engineer to make the 8-inch pipe a minimum for his sewer mains.

Delay of Contractor in Beginning Work.

Will you kindly advise me as to the proper procedure to follow in case a contractor refuses to commence work after having received a contract for street paving? The time limit has not expired at this writing, but it will be impossible for the contractor to finish the job within the specified time if he were to start at once. The city has the company's bond for the execution of the contract and, being anxious to have the work done, wants to know what action to take?

F. J. B., ——, Cal.

This is a question for an attorney familiar with California statutes and customs and with the terms of the contract. Generally speaking, it is difficult to start a contractor so long as he is keeping within the letter of his contract. In case you think he can not finish the work within the specified time if he begins at once, you may be making yourself trouble in collecting damages for failure to complete the work on time by trying to force him to do something which you think is impossible. If the contract has a clause assessing damages for failure to complete the contract on time at a given rate per day, the threat to enforce that provision seems to be about the only pord the city has.

Where to Obtain Standard Specifications.

Will you kindly inform me where I can obtain copies of the specifications for various classes of street paving adopted by the "Organization for the Standardization of Street Pavements?"

Also, will you give me the name and address of the Secretary of the "American Society of Civil Engineers?"

W. H. ASPINWALL, Bartlesville, Okla.

The Association for Standardizing Paving Specifications has recently issued its latest volume of proceedings, containing the standard paving specifications adopted, and the book can be obtained for $5 from the secretary, John B. Hittell. Engineer of Streets, City Hall, Chicago, Ill.

Charles Warren Hunt, 220 W. 57th St., is secretary of the American Society of Civil Engineers.

Right of City to Charge for Sewer Connections.

Can you give me the names of some cities, preferably in Texas, that make a monthly or yearly charge for sewer service? Can you refer me to any court decisions affirming or denying to a city the right to make such a charge.

I. B. D., City Engineer, ———, Tex.

Can our readers give us the names of such cities

It is quite common to make a flat charge for connection with sewer, and in some cases

the city is ultimately reimbursed for the total cost of the sewer by means of the collection of such fees. The right of the city to make such charges is affirmed by such decisions as that reported in MUNICIPAL ENGINEERING, vol. xl, p. 441, in the case of Harter v. Barkley et al., (Cal.) 112 P. R., 556.

There are several cities in the south, notably in Arkansas and Texas, which have private systems of sewers making charges of this sort. Their right to do so is apparently affirmed by a decision reported in MUNICIPAL ENGINEERING, vol. xxxix, p. 217, in the case of Pulaski Heights Sewerage Co. et al., v. Loughborough (Ark.) 129 S. W., 536, in which the right of the court to fix the charge in some cases is asserted.

A list of cities having sewers on the franchise plan is given in vol. xxxix, p. 40, and there is a list of articles on various phases of this subject in vol. xxxix, p. 35.

Methods of assessment for sewers are discussed in vol. xxxviii, pp. 190, 191 and 421, with numerous references to previous articles, some of which touch the subject of the question.

The articles on "Joint Sewer Connections" in vol. xxxi, p. 452, and vol. xx, p. 83, discuss the subject from still another point of view.

The right of the city or of the sewerage company to make a charge for connecting with the sewer being affirmed, the only question is as to the form of the charge, whether a sum payable on making the demand, payable in installments or payable as an indefinite annual rental. The three methods would seem to be similar in principle and equally subject to approval by the court unless there is some statute in opposition to one or more of them.

Who Has Control of Water Meter?

The Board of Water Commissioners of this village, believing that certain water meters were being tampered with, made a ru ing that all meters should be sealed, and proceeded to place a seal upon the meters. In some cases the meters are owned by the individuals using the water and in one of these cases, the individual broke the seal and contends that the Board has no right thus to assume jurisdiction over his property.

I believe that the Board of Water Commissioners have a right to enact any reasonable regulations for the control and supervision of the water system and that they were acting entirely in their rights in causing a seal to be put upon any and all meters through which municipal water passes, regard ess of where the ownership of the meter may lie. I would thank you to send me an opinion and authorities upon the question if you have any.

E. S. W., Village Attorney,
———, N. Y.

The Water Commissioners certainly have control over the use of water and can make such regulations as will insure accuracy of reading of meters, provided such regulations do not interfere with the free legitimate use of water. The writer believes that the meters should be the property of the water plant, and not of the consumer, both because that is the logical ownership and because the control of the water and of its measurement can not then be questioned. But the fact that the consumer owns the meter does not abridge the right of the Water Commissioners to control the water nor to insure the accuracy of the measurement of its use, though it might in some cases restrict the choice of methods in which this control may be exercised.

Cases having more or less bearing upon the subject have been reported in MUNICIPAL ENGINEERING, as follows:

In vol. xi: Right to install meters affirmed, p. 527, Pond v. New Rochelle Water Co. (N. Y.) 127 N. Y. S., 582. Right to restrict use of water affirmed, p. 526, Kimbal v. Northeast Harbor Water Co. (Me.) 78 A. R., 865.

In vol. xxxix: Service must be without discrimination in kind or rates, p. 44, State ex rel. Ferguson v. Birmingham Waterworks Co. (Ala.) 51 S., 354. Meters at Company's Expense, p. 218, Wilson Water and Electric Co. v. City of Arkadelphia (Ark.) 129 S. W., 1094. Right to make regulations affirmed, p. 217, City of Mansfield v. Humphreys Mfg. Co. (Ohio) 92 N. E., 233. Discrimination is illegal, p. 125, People v. Albion Waterworks Co. (N. Y.) 121 N. Y., 660.

In vol. xxxvi, p. 186: Two decisions regarding regulations governing meters and who shall pay for them; one by the Wisconsin Railroad Commission that the plant must furnish meters, and one in the case of the State ex rel. Hallauer v. Gosnell, 116 Wis., 606, confirming some rather stringent regulations of meters and service pipes. An article on "Ownership of Water Meters," p. 178, gives references to many previous articles bearing directly on the subject of the question as well as on the subject covered by the title.

Books on Gas Construction.

A gas company has recently acquired a franchise to build and operate a gas plant in this city.

Will you please refer me to a book or books that will give the engineering side of the gas business in regard to the placing of mains in the streets, of gas plumbing, of the damage done to pavement by gas, of the laws and regulations of the gas business, etc.

I have charge of the p.acing of the mains and the city's side of the supervision and I wish something that will give me a working knowledge.

G., City Engineer, ———, Ore.

The following books should be of interest in studying the problems of gas distribution most of them being English:

Hole's "The Distribution of Gas" ($7.50); "Self Instruction for Students in Gas Manufacture," a catechism in several volumes, two being on distribution, one elementary and one advanced ($1.75 each); Latta's "Handbook of American Gas Engineering Practice" ($4.50); Hughes's "Construction of Gas Works" ($4); Gerhard's "Gas Piping and Gas Fitting in Buildings," American practice ($3); Hughes and Gray's "Practical Gas Fitting," American ($1).

The following articles in MUNICIPAL ENGINEERING will also be found valuable:

In vol. xl: Legal decision that gas company must prevent leakage, p. 526; "Sufficiency of Proposed Gas Franchise," p. 511; "Gas Processes and Rates," p. 38.

In vol. xxxix: "Information About Gas Masufacture," p. 389; "The Regulation of the Amount of Sulphur in Gas," p. 156.

Title to Recorded Reservations for Parks.

This borough is thirteen years of age, and when the East Side Land Company laid out the town it incorporated in its plan two parks, but in recording it reserved the parks so called. In all the advertisements, representations and maps it set forth the parks, and in deeds it made reference, in describing the lots as abutting or contiguous to the parks. It never made any claim on the parks, never paid taxes on the same, but left them entirely with the borough to use, take care of and protect.

What right of ownership does it have? By what authority can it step forward and make a deed to others for the parks?

The parks are practically worthless, being gullies. I would appreciate your opinion.

D. R., Burgess, ———, Pa.

This seems from the brief statement given to be one of those indefinite cases, the decision of which depends upon so many items of reservation, deed, record, claim, occupation, etc., that the rights of the borough in the parks can be determined definitely only after a hearing at which all the evidence can be brought together. It would seem that the parks must continue as parks, whether belonging to the borough or to the land company, and any one affected by their use for other purposes could enjoin such use or collect damages for breach of contract or trespass upon his rights, and possibly could enjoin transfer of title to any one except the municipality.

It is presumed that "the parks are practically worthless" for other purposes than their use as parks, for "gullies" can often be made very valuable for park purposes. If the former is true it should be possible to prevent the use of the ground for other purposes and then to secure at least tacit permission for the borough to assume control, even if the reservation of the park land is not sufficient authority for the assumption by the borough of ownership within the limitations of the reservation.

The laws of the State of Pennsylvania may or may not cover the case. The borough's attorney should be able to give information on this point as well as definite advice directly applicable to the case, which one outside the borough and state must discuss upon general principles only.

Drainage for Flat Streets.

We notice from time to time in your journal, questions answered which must be a great help to the questioner. We have a seashore town which has not very much fall from the ocean side to the bay and we are bothered with surface drainage. Originally this did not make so much difference because our streets were not thickly graveled, but now that they are graveled from curb to curb the water does not soak away, and we want to get some scheme of conducting it under our cross streets so that it will find its level to the bayside.

The town is about two and one-half squares wide and twenty squares long. We have about 5 feet fall in the two squares and a half to the meadow edge. I do not know of any inlet or sand trap that will be quite satisfactory to our purpose.

If, through your paper, you can give us any information about this, I shall greatly appreciate it.

R. F. ENGLE, Beach Haven, N. J.

I would be pleased with your suggestions and comment on the following proposition:

Given a system of paving with bitulithic having flat grades (0.4 per cent.) and level intersections; also there being no outlet for storm sewers without going a prohibitive distance. I should like a suggestion on carrying storm water across intersections by inlet and pipe culvert and particularly on the manner of outlet into the gutter again on the low side.

On several intersections it will require two 12-inch pipes and placing same level and just beneath the concrete foundation the inverts will be 1.67 feet below gutter at both the outlet and inlet; and since the grade to the next intersection is only 0.4 per cent. there is no chance to depress the gutter. Consequently the drain will remain full of water after each rain.

I do not find any catalogued casting with grating which might be used at the outlets, my idea being to have a removable grating set at an angle of 60 per cent.

I would be pleased to have suggestions on changes or substitutes.

What is the editor's opinion on carrying storm water over bitulithic pavement on the surface at intersections? I notice this done in some instances in several cities.

B. L. B., City Engineer, ———, Okla.

With reference to the first question the writer would suggest the propriety of short drains on the cross streets, starting from the corner of the highest longitudinal street and running to the "meadow edge." Each drain should start as near the surface as possible and be given the full fall to the water's edge. Inlets should be made at each curb corner passed by the drain to which water runs. The longitudinal streets should be graded so that the water will run to one end of each block or from the center of each block to the two ends. The depth of this drain may not be sufficient to lay it in the center of the street and allow connections to be made from the curb corners. In such case a drain must be laid under each gutter. This plan should take care of the street drainage completely.

A similar treatment would be necessary to take proper care of the drainage of the streets in the second case, except that the greater distance would probably permit the collection of the water into a single outlet sewer or drain. Anything short of this will be but a partial solution of the problem and, therefore, more or less unsatisfactory.

If it is necessary to carry the water over the surface wholly, the pavement, gravel or bitulithic on the streets which the water must cross, can be so graded and laid as to make a wide channel for the water to flow in, the bottom of which will be low enough

to take the water from the gutter of the cross street on the higher side and carry it across and deliver it to the gutter on the lower side. Unless the spread of water over a considerable area during rains is objectionable, the slope to the bottom of this channel along the street which is crossed by the water may be slight and the obstruction to traffic may thus be made a minimum.

If such open channels in the street can not be used, closed channels or culverts may be used. In the cases of both correspondents these culverts will be very shallow, since the bottoms must not drop below the gutters on the lower side of the street crossed by the water. It will, therefore, be necessary to make them wide and to cover them by substantial slabs, forming bridges across them or culvert tops. These slabs must be raised high enough to insure no obstruction to the flow of water and will produce some obstruction to travel near the gutters, and may even require some elevation of the center of the street. If carefully designed the street intersections will not be serious obstructions to traffic, however. The culverts below the levels of the gutters suggested by the second correspondent will be very unsatisfactory for, even with a street paved with bitulithic, more or less sand will deposit in them and they will be obstructed and must be cleaned out. If used, covered catch basins at upper and lower ends and provision for easy access to the whole length of the culvert must be provided. The bridges referred to will be expensive to maintain, but will be more satisfactory than the culverts below grade.

Have our readers anything to suggest for either case?

Breaking Grades of Streets on Hills.

We are at the present time paving some fifteen miles of our sidewalks with concrete paving and are at the same time curbing and grading the streets.

The streets running one way have extreme grades varying from 3 per cent. to 6 per cent, and the corresponding cross streets have much flatter grades and are in some cases very flat grades. The streets are 24 feet wide between curbs and are of a sandy clay soil, very easily washed. The streets are crowned about 10 inches.

The point in question is this: I am running the grades on the streets having the greatest fall between centers of the intersecting streets, and as the corners of a cross street are approached I break the grade 20 feet distant from the corner of the cross street and bring it up or down to meet the curb grade of the cross street. The curb elevations on all of the streets are kept level on points at right angles to the center line of the street. By doing this I keep the opposite sides of the streets level and the intersection corners practically level. This makes each street have a slightly greater grade from a point about 20 feet from each intersection corner, and the increase or decrease in grade is appreciable to the eye. If I start the grades of the streets having the greatest fall from the opposite corners of the cross streets and so break the grade for each square, I give the street the appearance of coming to a peak at each intersection. If I attempt to to make one corner lower than the other, I necessarily will have to make one curb grade on the cross street of a greater elevation than the other curb, and as the streets are only 24 feet between curb lines, this is, in my opinion, very undesirable and is only permissible in cases where it cannot be prevented.

Let me have your decision as to the best method in getting the grade at the corners of the cross streets and in running the grades on the streets having the greatest fall.

G. E. H., City Engineer,
———, Ala.

Not all the information desired is given. Assuming blocks 300 feet long, or 324 feet between centers of streets and 5 per cent. grade between these two points; if the grade is broken 20 feet from the curb, as suggested, the grade from this point to the curb line will be 8 per cent. at each end of the block. This is not so objectionable at the upper end of the block, unless there is a smooth, slippery pavement. Careful grading and maintenance will be required at the lower end of the block to prevent undue wash of storm water drainage to the gutters if not perfect. If the grade is run between curb lines then the fall will be 16.2 feet in 300 or 5.4 per cent., and the profile of the street will show alternate level stretches at street intersections 24 feet long and gradients of 5.4 per cent. each the length of the block between curbs of the intersecting streets. This would seem to be preferable to the scheme proposed, both because it is more simple and because it does not have the rather excessive 8 per cent. gradients.

In the case described by our correspondent the easiest way to set out the construction profile is to run the line between centers of streets, setting stake at curb line showing the elevation, which will be, as derived from the above, 0.8 foot above the straight grade line at the upper end of the block and 0.8 foot below at the lower end; set another stake 20 feet from the curb line of the intersecting street to show the break of grade at the point where the steep 8 per cent. grade meets the regular 5 per cent. grade line.

In the case described by the writer, set the curb stakes at the same elevation as the center of the street, this center elevation being the same as that fixed for the other method. Then run the grade line straight between lower curb line of upper cross street to upper curb line of lower cross street, at the per cent. fall necessary (5.4 in the case assumed).

The same procedure would be followed for other lengths of block, widths of streets and differences of elevation.

With 24-foot streets the curbs should be kept as nearly at the same elevation as possible.

It seems to the writer that his suggested plan will produce less appearance of "peak" than the one proposed by our correspondent.

What have our readers to suggest?

This subject has been discussed at considerable length in MUNICIPAL ENGINEERING at various times. In vol. xxxvii, pp. 181 and

256, and elsewhere in the same numbers (September and October, 1909,) will be found some information and also lists of previous articles and of books treating the subject from various points of view.

How to Compute Excavation for Grading Street.

Can you please tell me through your question department how the depth of a cut on a grade of a paving job can be ascertained?

For instance, as an example, a proposed work of 12,000 surface yards of pavement, the engineer giving 6,000 cu. yds. as an estimated quantity of grading. And knowing the amount of surface yards on a piece of work, where as yet the engineer has not an estimate of the amount of excavating to be done, after sizing up the work and coming to the conclusion that there is about an 8-inch cut, what formula do you suggest to find out the quantity of dirt to be taken out?

E. W. H., ———, Wis.

This question is too indefinite for satisfactory answer.

The average cut in the first example would be obtained by dividing the number of cubic yards of grading, 6,000, by the number of square yards of pavement, 12,000, the quotient being the average cut, 0.5 yard or 1.5 feet.

If the excavation in the second example is uniformly 8 inches the cubic yards of excavation would be obtained by multiplying the area of the pavement in square yards by 2/9, which is the 8-inch thickness expressed in yards.

These results are probably very rough approximations, unless the excavation is in a street already graded very nearly to the same form as the new grade and so must be checked by more careful measurements if the grading is a large part of the contract.

Reduction in Cost of Asphalt Paving in Milwaukee.

To the Editor of MUNICIPAL ENGINEERING:

Sir—There have been some developments in the matter of street paving in this city during the psat year which, we think, will very much interest your readers.

The average price for the first six months of 1910 for asphalt pavement was $2.39 per square yard.

Prior to 1910 the average price was usually considerably above this figure. We made certain changes in the specifications along lines of economy, always with the best possible expert advice, the binder course and brick gutters being eliminated, and other slight alterations made. This reduced the average price for the second six months of 1910 to $2.07 per square yard, a saving of 32 cents on each yard laid.

Since the very beginning Milwaukee asphalt pavements have been laid under "closed" specifications that created an absolute monopoly for the local political contracting ring. This spring we opened up these specifications along the line of the report of the Association of City Officials for Standardizing Paving Specifications, making a few changes in same under the advice of Mr. Lester Kirschbraun, director of the Chicago Paving Laboratory. Following the recommendations of the said Association of City Officials for Standardizing Paving Specifications, we also eliminated the five-year guarantee, substituting in its place provisions for the strictest inspection.

As a result of these new arrangements the price of asphalt pavement, including grading, 6-inch concrete foundation and 2-inch stone mixture sheet asphalt wearing surface, has taken a very decided drop of 65 cents per square yard. On Wednesday, May 24, we let three contracts aggregating 60,000 square yards, the prices on which were $1.40, $1.41 and $1.45 per square yard, respectively, averaging $1.42 per square yard. About 5 cents of this drop in price may be charged to a saving by eliminating the five-year guarantee and a few slight changes in the specifications made at this time; the other 60 cents reduction in price can be charged to nothing save the "graft" which existed under the old "closed" specifications that created a "monopoly" for the two local "political contracting" asphalt paving companies.

In other words, the price of asphalt paving has dropped about $1.00 within one year, not more than 40 cents of which reduction may be charged to economy, and the other 60 cents or more per square yard can only be accounted for as plain, ordinary "graft" under "closed" monopoly creating specifications. Milwaukee has approximately 1,000,000 square yards of this class of paving, which means that she has been mulcted in the past of just about $1,000,000 on this score alone.

C. A. MULLEN,
Supt. of Street Construction.
Milwaukee, Wis.

Who Supplies Chloride of Lime for Sewage Treatment?

Kindly give me the name and address of firm that handles chloride of lime in bulk for use for sewage treatment.

C. E., Oklahoma.

The following firms supply calcium chloride: Marblehead Lime Co., Masonic Temple, Chicago; Carbondale Calcium Co., Carbndale, Pa.; Cochrane Chemical Co., 55 Kilby street, Boston; Solvay Process Co., Syracuse and Detroit. Some Eastern firms are named in MUNICIPAL ENGINEERING, vol. xl, p. 41.

Amount of Jute in Sewer Joints.

Can you tell, approximately, the number of pounds of jute or oakum required for gaskets for, say 2,000 feet of 8-inch sewer, vitrified pipe?

J. A. W., Lexington, Mo.

This length of 8-inch sewer may use about 100 pounds of jute. The exact amount will depend on the specification and the style of joint used.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of composition, the fact is what is wanted. Use the Question Department for what you want to know. use this Department for what you can tell others.

Transverse Expansion Joint in Brick Road.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Enclosed herewith find a clipping from the *Conneaut News-Herald* of June 3. The pavement in question is a country road running from the city limits to the Pennsylvania state line. The writer, after reading this article, made it a point to inspect the pavement and found it exactly as stated in the county surveyor's article.

The pavement is in excellent condition, and we must admit that they got a very good application of the cement filler on this work. The pavement has been laid now for three years and shows no wear whatever, although it is the main road between the east and the west, and the traffic through from Cleveland to Buffalo and intermediate points passes over this road.

F. B. DUNN, Conneaut, O.

The clipping referred to reads as follows:

LETTER FROM J. S. MATSON, COUNTY ENGINEER.

In your issue of Monday, May 29, 1911, you refer to an explosion in the brick pavement on the East Conneaut road. You also state that this explosion was caused by the lack of expansion joints across the pavement. I would like to call your attention to a few facts in regard to this matter and the reasons that caused us to omit transverse expansion joints in this pavement.

We provided for expansion joints at the curbs and at the street car track. As an experiment, one transverse expansion joint was put in, extending from the street car track to the north curb. At this said joint the explosion occurred.

The pavement on the south side of the street car track, having no transverse joints, and subjected to the same amount of heat as the pavement on the north side of the car track, with one joint, remained sound. What would be the reasonable conclusion? At the time the specifications were drawn for this pavement we gave a great deal of consideration to this question. As the result of our investigation we found that the city of Cleveland did not use transverse expansion joints and did not believe in them. Neither did Cuyahoga county. The fact that neither Cleveland nor Cuyahoga county made use of these transverse expansion joints seemed conclusive evidence that their use was unwise, as the city of Cleveland and Cuyahoga county are known the country over as having a greater proportion of perfect brick streets and roadways than any other locality in the world.

Further investigation confirmed this conclusion. Mr. W. P. Blair, secretary of the National Paving Brick Manufacturers' Association, presented a great mass of evidence upon the subject and stated that the National Paving Brick Manufacturers' Association in its campaign for proper construction of brick pavements was absolutely opposed to transverse joints.

At the time this pavement was laid we came to the conclusion that the only wise course was not to use transverse expansion joints. It is my opinion today that such a course was proper. The explosion in this road instead of changing this opinion has strengthened it.

I would be most happy to go into this matter more fully with you, as I appreciate that you do not desire to advocate a course that would be against the public good.

J. S. MATSON, County Engineer.

W. P. BLAIR'S OPINION.

I may say that the foregoing is the consensus of opinion of the experienced engineers of the country upon this subject—that contraction and expansion follow the course of least resistance, and no one realizes more than engineers the power of this force, and when started in one direction it is tremendous.

There are some influences that control this force and its direction that engineers themselves do not understand fully, and yet no private engineer has either the means or the time at his command to solve some of these problems by research work.

Just this very thing is considered so important, however, that the United States government, through its Bureau of Standards, has brought into use the most delicate measuring instruments for the purpose of measuring these expansion forces. They have already put their pins in the celebrated Indianapolis Motor Speedway for this purpose. This speedway is constructed in the most approved manner, and I may say like methods were followed in the construction of the Conneaut road. Investigations of this character will be followed by the government in July, on the streets and highways of Cleveland and Cuyahoga county. Thus we may understand that these are not ordinary questions, but involve problems of the highest and yet minutest of scientific investigation.

Mixing Concrete for Street Paving.

To the Editor of MUNICIPAL ENGINEERING:

Sir—To mix and place concrete economically for street foundations it is necessary to have a specially designed mixer. The object is to handle materials with as few hand operations as possible. The machine must not be too expensive in first cost or operation. To get the most benefit from the cement used a batch mixer is necessary, and is specified by city engineers who want the best results.

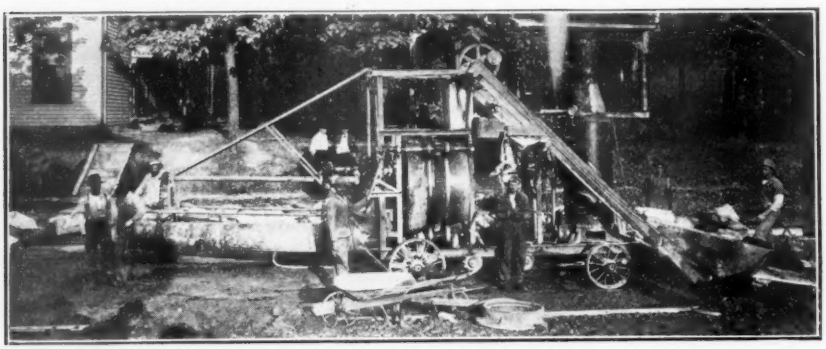
We have used for one season a Chicago street paving mixer which has a distributing drum on discharge end. It has laid about 20,000 street yards of 6-inch concrete during the last season without need of repairs. The same is equipped with an 8-h.p. engine and 10-h.p. boiler and the regular No. 14 Chicago mixer drum and automatic water tank, all of which are mounted in a heavy truck, the wheels of which have wide tread to protect the subgrade.

On each side of the boiler is a runway for the charging skips. There are two charging skips, each holding more than half the entire batch, which enables the charge to be loaded twice as fast as if only one skip were used, and also gives even keel to the machine. While the skips are up discharging into the mixer drum, the wheelers load their barrows and are ready to load skips as soon as they are lowered, thus working steadily and gaining time.

The skips empty into chute to mixer drum. The water is applied to the same for each batch from the automatic water tank, and as the mixing is very rapid the batch is discharged to the distributing drum after about one-half turn of the mixing drum.

The distributing drum is 18 inches in diameter and 15 feet 9 inches long and has blades riveted spirally on the inside. The same is supported by two roller chains from a gantry and swings in an arc of 180 degrees. One chain is an idler, but the other drives the drum at slow speed through the chain of gears from engine shaft. The spiral blades continue the mixing operation and also pass the concrete rapidly to the distributing end, where it is deposited where desired, by swinging the drum from side to side. Thus the material is handled by the machine from skip to final location in the street foundation. The concrete is run through wet enough so that when leveling and smoothing with shovels the grout comes to the surface, this being considered the best consistency for good concrete.

As the work progresses the machine is moved forward with its own traction and thus is a self-contained plant. It saves all wheeling of mixed concrete, and when the unmixed material is distributed carefully this wheel may be also kept down to the minimum. The use of wheelbarrows has been successful on the charging end for the reason that the men are loading barrows while skips are up. This saves time, as a barrow dumps into the skip practically as quick as a man can throw a scoopful, and the difference in quantity is immediately seen to be a saving in time. Also where an occasional longer wheel comes on account of scarce quantity of material, there is no delay.



CONCRETE MIXER FOR LAYING PAVEMENT FOUNDATIONS.

This machine laid the 6-inch concrete base in New Jersey street a total of 6,400 street yards. The total labor cost, including all delays, man in charge receiving material before work started, coal, etc., averaged 4⅞ cents per yard. We used 12 men as follows:

One foreman, per day	$5.00
One engineer, per day	5.00
Two men, smoothing and leveling concrete, each, per day	2.00
One man, discharging from mixer, per day	2.00
One man, cement, per day	2.00
Five men, loading skips, each per day	2.00
One man, cleaning grade, per day	2.00

With these men, as above, it was easy to maintain an average of 1,000 yards per day of ten hours. Many days as much as 1,200 yards were laid, proving the assertion that it is only the ability to get material into the

charging skips that governs the capacity of the machine. For instance, one day, or rather part of a day, 780 yards were laid in six hours, or at the rate of 1,300 yards in ten hours.

On the average basis of 1,000 yards per ten hours with the men as stated, the labor amounts to $30.00, to which add $2.00 for coal and oil, gives a total of $32.00, or at the rate of 3.2 cents per yard. After using this machine for one season we are highly pleased with the same.

THE MARION COUNTY CONSTRUCTION CO.,
BY W. L. SMITH, Indianapolis, Ind.

Bituminous and Cement Fillers for Brick Pavements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Please make the following corrections to the descriptions of pictures in my letter about "Bituminous and Cement Fillers for Brick Pavements," which appeared in the June number of MUNICIPAL ENGINEERING, beginning on page 517. On page 519 photograph No. 4 is cement filled instead of pitch filled, and the same applies to photograph No. 5, on page 520. Otherwise I was very much pleased with the article.

F. B. DUNN, Conneaut, O.

Country Roads, Their Care and Repair.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The one essential in road repair and maintenance is to cure the bad spots in same. The fault with most past attempts at country road fixing has been that they have tried to and have fixed up parts of the road that did not need fixing. A very large proportion of them are only bad in spots, and as a rule these spots are few and far between; but a road (like a chain which is only as strong as its weakest link) is only as good a burden bearer as the worst place in it to pass through. When you stick in one of them you have exceeded in your load the limit of that road. Now, instead of curing these bad spots, yes, even to picking out the worst of them to cure first, the rule is to mark off a certain section of roadway and decree so much covering for this whole section with either crushed stone or gravel, and when they have spread this they will still find they have the depressions, as the covering will not compress on the hard parts of the road as it will in the soft places, and so they have not cured the water pockets, nor the bad spots in the road. I wish to emphasize the necessity of first curing these soft spots, as once they will carry a load, it will not be found necessary to do much of anything more on the rest of the road to make it carry its load.

My critics will probably say we have been filling these places for ages with the one result; but my reply is that you have not been giving them a scientific filling, or used methods that would promise lasting results. The proper method in using untreated material is to fill to a good crown, and be careful not to slop over. The filling should be wet, so as to pack as firmly as possible. It will not need a great deal of tamping, as the traffic over it, with a little nursing, will pack it more firmly than would be possible from any other method. This nursing constitutes one of the scientific methods of road repair, and by nursing I mean the pushing back of the filling that has been crowded out by the traffic, especially after a rain. At this time it will be well to have a cart load of filling material along, and if the filling has been so packed or removed as to leave a depression, fill in again to a crown, thus eliminating the water pocket. Care should be taken in these fillings not to spread over onto the hard road surface surrounding these holes, as in that case you are likely to still have a pocket, in fact, will have both a hill and a hollow, and an imperfect patch.

The drawback and unsatisfactory experience one has with the untreated roadway is its rapid drying out, loosening and shifting tendencies. This is overcome by the use of the calcium chloride road mixture, which gives ten times the moisture bond and damp packed condition to your road patch that is possible from a natural, untreated surface, and one ton of this chemical, costing $13, will fix up a car load of gravel, costing from $25 to $40, and a car load of this mixture will go a long way in filling dangerous or load-sticking holes in the ordinary country road. With this mixture the nursing spoken of above is equally essential, and you will get ten times the service, and very much more satisfactory results than with the untreated surface; but in either case the little care needed to keep the patch in place and fully up to its duty will be found a well-paying expenditure of time and effort.

The chemical used in this combination is virtually a chemical sponge, having ten times the absorption and evaporating properties of any other known substance. It is this moisture-absorbing and retaining feature that makes a patch made of the combination so lasting and satisfactory. The bond of moisture also given the lower strata of the patch insures its packing and staying in place under very trying usage. In fact, generally speaking, the harder the usage, the more solid it becomes. This lower reservoir of moisture also, besides tending to hold this lower body in bond, gives a reserved supply of moisture to the top surface layer, and so tends to longer hold it in place. In excessive and long-continued drouths the top layer would be likely to loosen and shift a little; but the first rain would tie it down again as firm as ever; or if convenient to give it a light sprinkle once or twice a week you would be assured of perfect conditions at all times.

Now, as stated in another part of this article, I do not believe it is necessary or

desirable as a rule to cover the entire surface of most of our country roads with a foreign substance. It may take some time, possibly two or three seasons, to find and cure all the bad spots in a roadway; but once you have found and cured them, you will find the cost has been but a trifle of what a whole resurfacing would have been, and you will have a roadway that you can maintain at a fraction the cost of the built-up roadway. There is one thing here that it might be desirable to do; that is to give the unfilled part of the roadway a treatment to lay the dust. This would consist of scraping and leveling the whole road surface so as to get a runaway for the surplus water, as this chemical after absorbing its fill (and this will not develop into mud) will take no more, so all surplusage should be allowed to drain off and run away. Then scratch this leveled road surface lightly with a fine-toothed harrow or rake and scatter broadcast about 1½ pounds of chemical to the square yard, and after a couple of hours work it in with a rake or harrow. This spreading of the chemical can be done with some of the mechanical seed sowers, notably the Buckeye, or by hand with a shovel or tin scoop. It is only a question of getting it spread as evenly as possible, so that it will give an even distribution of the moisture, and to have it protected from a too free action of the sun and wind, and so keep it from drying out too fast. This will give a compact and dustless surface, and a pleasanter one to ride or drive over, than you will get from any of the built-up roads. And one that will cost far less to keep up and in good repair than any known made road.

To insure the smallest possible chance of rutting you should give the road as good a drainage as possible. This is easily attainable in a majority of cases, and would have to be provided in every case where any form of built-up roadway was put in, generally in a much more expensive form than will answer on a common dirt road. It is possible that to find and cure all the soft spots in a roadway would require, as stated above, two to three years; but with drainage such as I have suggested, once the bad spots were filled they would have very little further trouble with the road, and I think in only a few cases would it be found necessary or desirable to top the road with either stone or gravel.

Everyone knows that all the dust accretions that are blown from the road surface are a waste of road material, and all close observers of growing vegetation are aware that nothing is more detrimental to it than a thick coat of dust and a light wetting, such as the bulk of our light showers give, so that it is desirable to hold this dust in bondage wherever possible, and the chemical treatment will do that perfectly. The cost is trifling, when the saving to the road is considered, together with protection to the shrub, flower, plant and tree life, so that little excuse can be given for maintaining impassable roads.

S. G. Howe, Detroit, Mich.

Concrete Foundation Under Steam Railway Track.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In your April issue, page 351, you request information about concrete foundation under steam railroad tracks.

Until March 1 I was on the engineering corps of the E. & T. H. Railway Co., and during this last winter superintended the construction of a concrete foundation, ballasting, curbing, relaying with 85-lb. rail and new ties of the union or transfer track between the E. & T. H. and L. & N. railroads in Evansville. This track lies in a brick street, and as all of the Chicago-Florida and Chicago-New Orleans traffic, both freight and passenger, goes over this track (all that part of the traffic that goes through Evansville over these two roads), it was necessary to provide a very substantial foundation, because there are some very heavy trains to cross it.

The work was started December 1 and completed March 1, which also makes it interesting. J. G. B., ———, Ind.

Central Electric Station Power Rates and Economy.

To the Editor of MUNICIPAL ENGINEERING:

Sir—From the public's point of view the method fixing the proper price of electricity is usually a mystery. The various forms of sliding scales of price and discounts used by the electric lighting companies arise from the practical impossibility of cheaply storing electric energy. Since the consumer usually has the right to call upon the electric light company at any time for the maximum amount of electric energy required by his installation of lamps or machinery, the electric light department must prepare to meet his demand by installing an equal amount of generating machinery, although it is quite possible that the consumer may have use for his maximum demand only once in a year, or never at all.

The rate question has been one of the most widely discussed topics to date, both among and outside of those engaged in the operation of electric public service installations. In the majority of cities and towns the rates for electric light and power service have been made without a study of the costs to the producer, or manufacturer, and user, of the motors in the various manufacturing establishments and industries; or a study of the ways and means to reduce the cost of operation to the consumer and still receive as high a rate for the energy furnished as is consistent with the continuous and satisfactory service, thereby securing maximum return to the elec-

tric department with a minimum investment in plant, copper and distribution equipment, at the same time reducing the cost of energy to the consumer and allowing him a greater margin in the manufactured article.

The effect on the central station and consumer will be surprising if the motor service is given a fair trial. Beginning at the station, it will be found a fact that most engines operating at or about one-quarter load will require from 60 per cent. to 70 per cent. of the steam required to operate at full load. Now, what does this mean to the operating costs In the first place, there is only a very small increase in operating expenses, such as oil, waste and maintenance, no additional expense for labor, and almost none for fuel up to a point very near full load for a motor load operating between the hours of 6 a. m. and 5 p. m., equal to the peak load at night.

These facts also bring up the question of the type of motor to be most suitable for the department and the question of rating; the effect of the price of the motor on both the business prospects of the department and that of the prospective customer.

The most efficient motor will probably be the highest in first cost, and the purchaser may object to the cost when comparing the prices with some other make and type of motor. Where does this affect him as compared with the department In any case there is only a slight difference in the price, which the purchaser pays but once if the most efficient motor is purchased, but which is paid for many times by both the department and the purchaser if the cheaper and less efficient motor is purchased by the consumer to save slightly in first cost. The purchase of a motor of low efficiency requires the department to make a larger outlay in both line and equipment, with the subsequent losses and the inevitable result is that the department is compelled to charge more for the service than it would have to do with the more efficient unit; the purchaser pays more for his service, both because his unit consumes more energy and because it costs the department more to manufacture the energy.

The question of the maximum return per kilowatt in plant, copper and transformers will, or should, determine the type of motor to be used, as the effect of the motors on the regulation will be found practically nil as compared to what will be found in a large number of stations if the proper transformers and generators are installed for inductive loads, with a carefully arranged motor installation. This is especially true of the transformers. The regulation is also affected by the size of the motors and the load they carry to a very great extent.

The control of the size is the next question. The rates for motor service should be so worked out that a motor only large enough to do the average work required, even if overloaded occasionally, would be installed, for why should the department install equipment lines and transformers for a customer who thinks he may install some machinery additionally at some future period which also depends on the growth of his business and may require 25 per cent. to 75 per cent. more outlay?

The effect of this on the department is that the motor is about half-loaded, probably less, the power factor is low, resulting in reduced capacity of feeders for others, heats the transformers and requires more equipment at the plant, and does not permit of the operation of the engines at the maximum efficiency.

The rate is so made that the smaller the motor installed and the nearer to full load that it is operated, and the longer the hours it is operated the lower the rate. This statement applies to all consumers, large and small, though there will be a slight increase to the small consumer, due to the fact that a small installation costs more per kilowatt and the losses are greater. It costs as much to read meters, bill and collect for the small consumer as it does for the large, although the kilowatt hours consumed will be very much less. The rate favors the long-hour consumer and induces him to lay out his plant so as to reduce to a minimum the cost of shafting and hangers in use that do not produce a revenue, grouping his machines for proper routing of material, and keeping those machines together that are used more continuously. This arrangement, together with accessibility, will result in greater output for the customer and secure a high power factor with consequent reduction in the size of transformers and meters installed.

WILLIAM PLATTNER,
Manager Municipal Electric Light Department, North Attleborough, Mass.

Following is the schedule of rates used by the department:

—Power Rates—

Voted—To allow a discount of ten (10) per cent. on commercial lighting sold after June 1, provided the bill is paid on or before the 16th day of the month following the month in which the current is consumed. No discount allowed on minimum charge.

Voted—To allow a discount of ten (10) per cent. on power current sold after June 1, provided the bill is paid on or before the 16th day of the month following the month in which the current is consumed. No discount allowed on minimum charge.

NORTH ATTLEBOROUGH ELECTRIC LIGHT DEPARTMENT.

CONTINUOUS RATE—POWER RATES.

H. P. Demand.	Rate per Demand.	Kilowatt Equivalent.	Rate per Kilowatt Hour.	Current Charge.	Total Monthly Charge.	Discount.	Net Monthly Charge.	10 per Cent. 16 Days.	Net per Kilowatt Hour.	Rate H. P. per Year.
1	2.00	176	.0275	4.84	6.84	..	6.84	6.16	.035	73.92
2	4.00	352	.0275	9.68	13.68	..	13.68	12.32	.035	73.92
3	6.00	528	.0275	14.52	20.52	..	20.52	18.47	.035	73.92
4	8.00	704	.0275	19.36	27.36	..	27.36	24.63	.035	73.92
5	10.00	880	.0275	24.20	34.20	2	33.52	30.17	.0342	72.52
6	12.00	1056	.0275	29.04	41.04	4	39.40	35.46	.0335	70.77
7	14.00	1232	.0275	33.88	47.88	6	45.01	40.51	.0328	69.44
8	16.00	1408	.0275	38.72	54.72	8	50.34	45.31	.0321	67.96
9	18.00	1584	.0275	43.56	61.56	10	55.40	49.86	.0314	66.48
10	20.00	1760	.0275	48.40	68.40	12	60.19	54.18	.0307	65.01
15	30.00	2640	.0275	72.60	102.60	15	87.21	78.49	.0297	62.81
20	40.00	3520	.0275	96.80	136.80	17.5	112.86	101.58	.0288	60.94
25	50.00	4400	.0275	121.00	171.00	20	136.80	123.12	.0279	59.09
30	60.00	5280	.0275	145.20	205.20	22.5	159.03	143.13	.0271	57.25
35	70.00	6160	.0275	169.40	239.40	25	179.55	161.60	.0262	55.40
40	80.00	7040	.0275	193.60	273.60	27.5	198.36	178.53	.0253	53.55
45	90.00	7920	.0275	217.80	307.80	30	215.46	193.92	.0244	51.71
50	100.00	8800	.0275	242.00	343.00	32.5	230.85	207.77	.0236	49.86
75	150.00	13200	.0275	363.00	513.00	35	333.45	300.11	.0227	48.01
100	200.00	17600	.0275	484.00	684.00	40	410.40	369.36	.0209	44.32

INTERMITTENT CHARGE.

—Discount Sheet for Meter Readings—

(List price, 10c per kilowatt hour, or 7½c per horsepower hour.)

Meter readings kilowatt (1000 watt) hours per month.	Equivalent to follow steady horsepower.	Per Cent. Discount.	Net Price per kilowatt hour.	Cents per horsepower hour.	Price per year per steady horsepower 3000 hours.	Minimum bill per month.
0— 50	...	0	.10	.075	$225.00	.....
50— 100	.26	5	.095	.07125	213.75	$4.75
100— 175	.53	10	.09	.0675	202.50	9.00
175— 250	.93	15	.085	.0638	191.40	14.87
250— 350	1.32	20	.08	.06	180.00	20.00
350— 475	1.86	25	.075	.0563	168.90	26.25
475— 650	2.53	30	.07	.0525	157.50	32.25
650— 850	3.46	35	.065	.0487	146.25	42.25
850—1050	4.52	40	.06	.045	135.00	51.00
1050—1200	5.58	44	.056	.042	126.00	58.80
1200—1400	6.36	47	.053	.03975	119.25	63.60
1400—1600	7.42	50	.05	.0375	112.50	70.00
1600—1800	8.48	53	.047	.0352	105.60	75.20
1800—2000	9.54	56	.044	.033	99.00	79.20
2000—2200	10.60	58	.042	.0315	94.50	84.00
2200—2400	11.66	60	.04	.03	90.00	88.00
2400—2800	12.72	62	.038	.0285	85.50	91.20
2800—3200	14.84	64	.036	.027	81.00	100.80
3200—3500	16.96	66	.034	.0255	76.50	108.80
3500—4000	18.65	67	.033	.02475	74.25	115.50
4000—5000	21.20	68	.032	.024	72.00	128.00
5000—6500	26.50	69	.031	.02325	69.75	155.00
6500—8000	34.60	70	.03	.0225	67.50	195.00

A minimum charge of one $1.00 dollar per horse power per month on all motors will be made for power whenever the monthly bill as shown by the meter is less than that amount.

MUNICIPAL MATTERS IN COURT

Higher Courts—Rights of a Municipality to Fix Water Rates.

Decisions of the Higher Courts of Interest to Municipalities.

The Right to Change Street Grades for Public Necessity.—The rule that, where a work of public necessity has been performed within a street through the properly constituted officials, under statutory authority and without negligence, no legal liability arises in favor of an abutting property owner for consequential damages, denies a right of action to a property owner for injuries resulting from a change of the grade of a street on which his property abuts. An owner of property abutting on a street has a right of access from his premises to the street, but he may not demand that the grade of the street shall not be changed in case the public benefit demands it, merely because it interferes with his right of access, since that is subject to the rights of the state, through the municipality as its agent, to improve the street or to change the grade when the public necessity demands it.—Morris et al. v. City of Indianapolis et al. (Ind.), 94 N. E. 705.

Liability of Street Railway Company for Sprinkling Streets.—A street railway's duty under an ordinance to sprinkle the part of streets occupied by its tracks is a public one, and enforceable by mandamus. An ordinance requiring a street railroad to sprinkle the part of streets occupied by it is not void as discriminating in favor of users of automobiles and other vehicles who are not compelled to bear the expense.—State ex rel. City of Milwaukee v. Milwaukee Electric Ry. & Light Co. (Wis.), 129 N. W. 623.

Rights of a Dismissed Appointive Officer.—Where an appointive officer was improperly dismissed without notice, and it did not appear by the complaint in his suit for his salary thereafter accruing that any other person had been appointed in his place, the complaint was not demurrable on the ground that plaintiff must first establish his title to the office by *quo warranto* before bringing action for his salary—Leonard v. City of Terre Haute (Ind.), 93 N. E. 872.

Rights of a City Buying Land for a Street.—A city contracting to buy land to widen a street could not undertake with the owner to move his building, make a fill on land retained by him, re-establish fences, etc., nor to indemnify him against risks in moving the building as to persons and property.—Wheeler v. City of Sault Ste. Marie, 129 N. W. 685.

Rights of a City to Vacate Streets.—The court in determining whether there should be a vacation of streets in proceedings authorizing the vacation of plats and streets and alleys thereon, must consider reasonable future requirements, and the fact that the streets are considered necessary for use by the city for water and sewer pipes shows that they will also be needed for use by the general public, and they should not be vacated.—Gale v. City of Cedar Rapids (Ia.), 129 N. W. 737.

Continuation of the Right of Franchise.—Laws 1846, c. 216, created the Hudson River Railroad Co. with power to construct a railroad, commencing in the city of New York and extending to some point on the Hudson river opposite the city of Albany, authorizing the directors to locate their road on any of the streets or avenues of the city of New York, within specified limits, provided the consent of the corporation was first obtained. The act provided that the corporation should continue for 50 years, and by ordinance of the New York City council, passed May 6, 1847, the railroad's route along the streets of the city was specified and confirmed. Under authority of Laws 1869, c. 917, a consolidation of the Hudson River Ry. Co. with certain other corporations that had been formed to operate a continuous line from Albany to Buffalo was made, by which the consolidated company when formed was to continue for 500 years, and succeed to all the rights, privileges and franchises of each of the corporations included therein. Held, that the franchises thus transferred were not limited by the period of the original grants to the consolidated corporations, but that the consolidation operated as a new grant to the new corporation during the period of its corporate existence, thus vesting in the consolidated corporations a right to operate trains over the tracks laid in the streets of the city of New York for the term of 500 years.—New York Central & H. R. Ry. Co. v. City of New York et al. (N. Y.), 127 N. Y. S. 513.

City Not Liable for Debts of Condemned Water Company Incurred in Process of Acquiring Company.—Where, in proceedings by a village to condemn for public use the property of a water works company, the company employed an attorney who ren-

dered services resulting in securing a larger award, the attorney did not acquire any lien on the ward as against mortgage bondholders of the company.—Farmers Loan & Trust Co. v. Weschester County Water Works Co. et al. (N. Y.), 127 N. Y. S. 569.

City Not Liable for Delaying Contractor.—A street contractor having begun work on being notified to proceed under his contract, though he had notified the city that he would not build the street under the contract price because cost of labor and material had advanced while he was delayed in commencing work, cannot recover damages for the city's breach of the contract in so delaying him.—City of Newport v. Schoolfield (Ky.), 134 S. W. 503.

Maintenance of Excavations Under Sidewalks.—If the owner of city lots constructs a building thereon adjacent to a street of the city, and in such construction excavates a large space under the street to be used as a room in connection with said building, and so maintains the same for several years, it will be presumed that such excavation was made with the consent of the authorities of the city, and upon the implied condition that such excavation shall be maintained in proper and safe condition for travel along the street and walks thereon; and the owner of the property will be liable for damages caused by his neglect to so maintain said excavation.—City of Omaha v. Philadelphia Mortgage & Trust Co. (Neb.), 129 N. W. 996.

Individual May Not Obstruct Stream So as to Cause Injury to Property of Others.—Where a city, for the relief of its streets from floods, discharged its sewers into a stream flowing through it, and one placed an obstruction in the stream, causing general injury to property in the neighborhood and to the streets, the obstruction was a nuisance. A city adopted an ordinance for the construction of a conduit of specified capacity for the waters of a stream within the city, and declared that the conduit should be constructed under plans of the city engineer and subject to his inspection. The individual constructing the conduit did not procure any plans from the engineer, and the engineer never approved any plans, nor was he asked to make any inspection of the structure. *Held*, that the city was not estopped from complaining that the conduit did not comply with the ordinance.—Sioux City v. Simons Hardware Co. (Ia.), 129 N. W. 978.

Rights of Cities to Issue Bonds for Acquiring Public Utilities.—An Act authorizing any city to acquire, own and operate public utilities, and to issue mortgage bonds therefor beyond the general limit of bonded indebtedness, provided such mortgage bonds shall not impose any liability on the city, but shall be secured only by the property and revenue of the public utility required, authorizes a city to issue its bonds, within its debt limit, for the acquisition of public utilities, which bonds are a liability against the city, and to issue bonds beyond the debt limit which are secured only on the property and revenue of the public utilities, which bonds are not within section 20, requiring general laws restricting powers of municipalities to contract debts.—Kuhn, Atty. Gen. v. Common Council of City of Detroit (Mich.), 129 N. W. 879.

Liability of Contractor Under Pavement Guarantee.—Where a contract for an asphalt pavement over a stone block pavement bound the contractor to keep the pavement in repair for 15 years, and with a sufficient foundation, and an asphalt pavement would begin to need repairs in 4 or 5 years, the contract will be deemed to contemplate the necessity of repairs during at least 10 of the 15 years, and not to be a guaranty that the pavement, if laid with the best material and workmanship, would not require repairs within the prescribed period on the ground that defects were not due to inferior workmanship or material but to defective plans of the pavement.—Asphalt Paving Co. v. City of New York (N. Y.), 127 N. Y. S. 794.

Pavement Guarantee Does Not Give Sole Right of Repair to Contractor.—A contract to repave the streets of a city and to maintain the same for a specified period after acceptance, which stipulates that the contractor agrees to make repairs, and during the period of maintenance to take up, lay, and restore on notice the pavement over trenches for water and gas pipes and sewers or other purposes, at a speciefid price, does not give the contractor an exclusive right to relay a pavement during the period of maintenance, and the act of the city in permitting a railway company to keep in repair the part of the streets used by its tracks, to take up and repair a street at its own expense by employing another contractor, is not a violation of the contract, since the railroad company, not being a party to the contract, is not bound thereby, and since the city does not agree to pay for such work.—Mack Paving Co. of New York v. City of New York (N. Y.), 127 N. Y. S. 738.

Right of an Individual to Fire Protection.—A property owner in a city has no right of action against a water company on its contract to furnish water to the city at public hydrants for the protection of his property from fires, though his loss may have been occasioned by the negligent failure of the water company to have on hand a sufficient supply to prevent the loss, there being no privity of contract between the property owner and the water company.—Niehaus Bros. Co. v. Centra Costa Water Co. (Cal.), 113 P. R. 375.

Bidding by Councilman on City Work Constitutes Fraud.—Where in an action on a contract for the construction of sanitary sewers for a city it appeared that the contractor was a firm, a partner of which was

a member of the city council at the time of the execution of the contract, evidence of other bids on the same work was relevant on the issue of fraud in procuring the contract. A contract by a city council with a firm, a partner of which is a member of the council, for public work is not invalid, in the absence of a statute, where it is free from fraud, and where the partner did not vote on the proposition nor take any part in behalf of the city in making the contract.—Mayor, etc., of City of Ensley v. J. E. Hollingsworth & Co. (Ala.), 54 S. R. 95.

Maintenance of a Water Works Is Not a Governmental Function of a City.—The operation of a system of waterworks is not such a governmental function as that a city is not liable for injuries resulting through negligence in the maintenance thereof. While this business is quasi public, it is not essentially governmental.—Huez et al. v. City of Atlanta (Ga.), 70 S. E. 71.

Rights of a Municipality in Fixing Water Rates.

An interesting case affecting the rights of a municipality to fix water rates has recently been decided by the Supreme Court of California. The City of Oakland, Cal., undertook in 1900 to regulate the rates of the Contra Costa Water Co. by ordinance. The water company stated that the rates specified in the ordinance were unreasonable and that sufficient opportunity had not been given the water company to show that the rates were oppressive. A judgment was rendered for the company in 1901 and an appeal to the Supreme Court of the state was taken after a motion for a new trial was denied in 1905. The Supreme Court decision, which was given recently, contains many points of value relative to rate legislation, some of which are as follows:

The court in determining whether water rates for a corporation formed to supply a city with water are confiscatory, must ascertain the value of the property on which the corporation is entitled to a return, and determine the percentage of return to which the corporation is entitled on such value, and where the rates yield less than the lowest percentage of return to which the corporation is entitled the rates are confiscatory.

Th court, in such case, must determine what is the lowest fair percentage, and where an ordinance gives a return which, though low, is not palpably unreasonable, the court may not disturb it.

The presumption is in favor of the validity of a legislative determination fixing rates for water furnished by a corporation to supply a city, and the burden is on the party attacking the rates to show their invalidity.

The provision in the State Constitution, declaring that the use of all water appropriated for sale, rental or distribution is a public use, subject to the control of the state and the rates to be collected for the use of water supplied to any city or the inhabitants thereof, must be fixed annually by the authorities, is sustained on the principle that where one devotes his property to a public use, he grants to the public an interest therein, and must submit to be controlled for the common good.

The exercise of the right by the state to establish reasonable compensation for services where private property is devoted to a public use, is a legislative function, whether the power is exercised directly by the legislature or by a subordinate or administrative body, and the courts have no authority to revise the action of the rate-fixing body.

A city ordinance fixing rates for water furnished by a corporation supplying a city cannot be set aside when enacted in the manner provided by law unless it is invalid on a constitutional ground.

The legislative body fixing rates for water furnished by a corporation supplying a city with water, on determining the present value of the property used in the public service, must fix such rates as will allow the corporation a fair return over and above its operating expenses, taxes and current repairs, and the annual depreciation in the property, and the questions of the value of the property and the amount of expenses, allowance for depreciation and fair compensation, are for the legislative body, and the courts will not set aside its action on the ground that it deprives a corporation of its property without fair compensation, unless that fact clearly appears.

An ordinance which affords a net revenue, over operating expenses and taxes, of 5.682 per cent. on the value of the property used in the service, cannot be adjudged invalid as fixing so low a rate as to be confiscatory, though there must be deducted a fair allowance for the ordinary annual depreciation in the value of the perishable portion of the plant.

A corporation is not entitled to any allowance in the annual fixing of rates to cover any past depreciation, but it is the value of the property at the time of fixing the rates that must be ascertained, and the only depreciation that can be allowed is such as may properly be apportioned to the year for which the rates are fixed.

Such corporation having a monopoly is not entitled to an allowance for good will in determining the value of the property used in the business on which it is entitled to a return.

In the absence of a finding on the question of the value of the property of the corporation, the court cannot determine that the compensation afforded by the ordinance is not reasonable, and, where reasonable, the corporation cannot complain in the courts because of the methods used by the city council in arriving at the conclusion embodied in the ordinance.

FIRE DEPARTMENT

A European Fire Department—Specifications for Fire Hose—Motor-Propelled Fire Apparatus.

A European Fire Department.

The report of Consul General Robert P. Skinner from Hamburg, Germany, contains a description of the fire department of that city and a comparison of this with American fire departments. This report is abstracted briefly as follows:

While the Hamburg fire department is an admirably organized institution, one of the best, if not the best, in Europe, and well adapted to local requirements, it may be doubted whether in the organization of its personnel or in its equipment it is in advance of the fire department of American cities of first rank. The local engines and all mechanical devices seem small, the signal boxes far apart, and the speed maintained in traversing the city rather slow, but as there is an established building line in Hamburg, as in all European cities, which seldom exceeds six stories, the extremely difficult problems that present themselves daily to firemen in American cities are here entirely unknown.

A Hamburg fireman who had occasion to visit the United States some years ago returned full of admiration for the splendid way in which American fire companies usually respond to alarms, and was of the opinion that the American companies were ready for action more promptly than those in Germany, because the individual units subordinated everything else to the point of leaving quarters, at the earliest possible instant, to do which the American firemen at night would slide down the pole partially clad, and was indifferent as to his appearance in riding to the scene of the fire, so long as he was on the spot to meet the emergency The European fireman, on the other hand, having had military training, would be inclined to avoid the pole, and would walk down the stairs, devoting a few seconds to the adjustment of his garments, and would be ready to appear before the public in regulation costume.

The Hamburg fire department is under the general direction of a branddirektor, who has under him two inspectors and nine brandmeisters, these latter being stationed in various city districts. There are 404 firemen and drivers, 114 inside men, and six office men. The brandmeisters are professional engineers who have passed examinations as such. The men composing the companies have had military training, necessarily, and must also have had some technical experience as carpenters, plumbers, electricians, locksmiths and the like. It is the duty of the chief, or branddirektor, not only to fight fires, but to enforce the city ordinances in regard to chimney cleaning, the handling of explosives, and the manufacture thereof.

The fire department renders aid in case of accidents and in removing interruptions to traffic. The direktor is also in possession of very elaborate data from the building department, which are distributed in all the local stations, showing the exact nature of all structures, these data being carefully studied and so prepared that upon reaching the scene of the fire the commander of the company is fully aware of the material situation.

The average time required in Hamburg for a company to be ready to start to a fire is under 18 seconds in the daytime and from 35 to 40 seconds at night. Alarms are sent in from boxes of the Siemens & Halske type combined with Morse telegraphic apparatus. There are in Hamburg 218 general alarm boxes, of which 16 are in the interior of buildings. Theoretically no box is more than 250 meters (820 feet) distant from any building. There are also 134 special alarm boxes in theaters, hospitals, and factories. To facilitate finding an alarm box in time of danger, signs are painted upon or next to every city letter box.

The equipment of the Hamburg department consists of 8 large and 14 small steam fire engines, 1 being a motor engine; 10 gas engines, 1 mounted on an electric motor; 11 hose carriages, 1 with an electric motor; 10 ladder carriages, 1 with an electric motor; 8 tool wagons; 1 tender; 25 ordinary hose reels; 15 hand-pressure fire engines; 3 tank wagons; and various service vehicles, including 49 bicycles.

For service in the port, in addition to the shore equipment, there is 1 fire boat owned by the city, supplemented by 16 ferryboats, which are equipped with pumps and other apparatus. These ferryboats, though used constantly for the transportation of passengers within the harbor, are subject to instant call in case of danger, answering a large fire bell which can be heard throughout the port. The companies owning these ferryboats receive a certain compensation from the government for thus aiding in the work of fighting fires.

In addition to the public organization described above there is a salvage corps working in harmony with the fire depart-

ment, but wholly under the control of the insurance companies doing business in the city, which support the institution entirely at their own expense. Detachments from this corps visit every fire and concentrate their efforts solely to saving property. The salvage corps owns 1 large motor wagon, 2 small motor wagons, a number of 3-wheel small motors, and a considerable number of motorcycles.

Specifications for Fire Hose.

At the recent annual meeting of the National Fire Protection Association there was presented a set of specifications for fire hose which are a great deal more of value than those which were in general use. Owing to the increased demand for first quality rubber in the manufacture of automobile inner tubes and other uses, it has been noted that the quality of rubber used in the fire hose was deteriorating. In many cases inferior grades and even reclaimed rubber has been used for fire hose.

Another fact which allowed of inferior quality hose was the practice of buying it under a short term guarantee. In many cases, the manufacturer furnished hose which he knew would in all probability last during the guarantee period. In fact, he many times figured that a few replaced sections would be necessary; but the cheapness of manufacture fully protected him against such replacements.

In preparing the new specifications, the committee of the National Fire Protection Association tested a number of samples of hose submitted by various cities, and found them almost without exception to be very poor.

The most common as well as the most important defect brought out in the investigation relates to the rubber linings employed. Extended analyses show that the percentage of gum used varies from about twenty-six (26) to fifty-two (52) per cent. and that low grade gums are almost invariably used. In only a vew few cases could any claim for high grade rubber have been justified and these did not meet requirements which constitute a reasonable minimum for rubber used in fire hose.

The following summary of the results of the chemical and physical analysis of a total of thirty-two samples will serve to indicate the general quality of the rubber lining used in the hose tested:

Seventeen linings classify as very inferior grade.

Twelve linings classify as low grade.

One lining classifies as medium grade.

Two linings classify as fair grade.

One lining classifies as high grade.

Average tensile strength, all samples	736.8 pounds
Righest average tensile strength for any hose	1,368. pounds
Lowest average tensile strength for any hose	199.5 pounds
Average elongation at breaking point for all samples	8.02 inches
Highest average elongation at the breaking point	11.9 inches
Lowest average elongation at the breaking point	4.2 inches

The defects found in the cotton fabrics of the samples tested were in many cases of secondary importance, the defects in wearing and in some cases short staple cotton were noted.

The cement backing used between the cotton fabric and the rubber lining presented a more serious defect, as in many cases it did not provide a sufficiently reliable joint between the tube and the jacket. Other instances were noted in which the cement had caused corrugations which were evident on the inner surface particularly near the couplings.

The couplings supplied presented one of the most serious defects in the samples tested, as poor machine work and inferior metal caused the rupture of couplings in three cases when short sections of hose were being tested under pressure. The connections provided between the hose and couplings were almost without exception very poor. The cotton fabric was doubled back in the coupling in many cases, and was quite badly cut by the corrugations in several instances. Sand pits and "fins" on the couplings, which would tend to cut the fabric, were also noted.

In the new specifications offered, the following important changes are recommended:

1. That the rubber lining be of the best quality rubber as determined by analysis. That its breaking strength be not less than thirteen hundred pounds per square inch. Further provisions are made relative to elasticity and chemical properties required.

2. That the couplings be of a specified quality weight and quality of brass, made and fitted in a workmanship manner.

3. That the hose shall be of specified weight and flexibility, and shall have a strength under pressure of certain prescribed amounts varying for single jacket, two jacket and three jacket.

4. That the elongation under pressure shall not exceed specified limits, and that the twist and warp under those conditions shall not exceed specified minimum.

The above include the points of difference in the new specifications for cotton rubber lined fire hose. In offering these specifications the committee suggests that they be rigidly enforced, as they embody no features which will tend to hinder or restrain the processes of manufacture.

Motor Propelled Fire Apparatus.

BY LOUIS ALMGREN, JR., CHIEF OF THE FIRE DEPARTMENT OF SAN DIEGO.

The manufacturers of fire apparatus in this country have been carefully watching the development of the gasoline motor for

the purpose of introducing it into the fire department service. A great deal of time has been expended in this field, to the end that satisfactory results have been obtained in perfecting some forms of motor propelled fire apparatus.

We know that most fires are discovered before they get much headway and the amount of damage they do depends upon the time it takes to get the apparatus with the means to extinguish it on the scene. The motor propelled apparatus for average distances to travel is quicker than the horse-drawn apparatus, the greater the distance the more gain for the auto, and its ability at all times to get men and equipment to the fire with the least possible delay, proves beyond a doubt its great value in a business often involving the loss of life and property and hours of hard work; further, it is conceded that men who ride to fires on apparatus ready to go to work at the early stages of the fire are more valuable than men arriving some minutes later; it is a matter of record that most fires are under control within ten or fifteen minutes after they start.

The motor propelled combination hose and chemical apparatus has proven its superior worth over the horse-drawn apparatus. It is considered by fire department officials throughout the country an indispensable fire fighting unit; some go so far as to say that it has obsoleted for use in certain communities the horse-drawn apparatus. It can be utilized to convey persons injured to hospitals; as a fuel wagon, fuel can be furnished to engines more expeditiously, especially when the engines are some distance from the base of supply; if necessary it can be dispatched to stations for the relay hose held in reserve, and thereby save calling extra apparatus to the fire and jeopardizing the protection already minimized.

It has proven a great success in handling brush and grass fires. As a rule these fires occur in outlying districts remote from the fire limits, and the fact that the auto combination can get to this fire before it has spread to any great extent and extinguish it, return to station and be ready immediately for the next run, demonstrates the superiority of the auto over the horse-drawn apparatus for such service.

Another advantage, while not in the fire fighting line, is important, the absence of horses from the station eliminates the extra labor for their care and the risk of loss by injury or sickness, also the smell and noise, which is an improvement in conditions appreciated by a fireman.

In housing the apparatus economy appears in favor of the auto apparatus, a space ten by twenty feet is sufficient to house it; no stalls, hay and grain rooms, or extra plumbing, heating or sewer connections are required.

The purchase price of the motor propelled apparatus will exceed the horse-drawn apparatus two or three thousand dollars, but this sum is insignificant when the cost of maintaining the horse apparatus is considered, and the fact that the auto will efficiently cover three times the territory that the horse-drawn apparatus will.

In the case of a general alarm the auto apparatus can be concentrated for service expeditiously, which is not true in the case of the horse-drawn apparatus. In cities where motor propelled apparatus is used, all alarms are responded to by an auxiliary squad dispatched in an auto vehicle, the ability of this squad to render efficient service makes it possible to maintain smaller companies in the outlying districts. This is an economy directly attributive to the auto vehicle and should not be overlooked in considering the advantages of the auto over the horse-drawn apparatus.

In small towns and outlying districts where small volume and fair pressure will suffice the combination engine has proven a success, it is also making an enviable record in cities where steep grades abroad, on account of its ability to mount the grades at a high rate of speed and arrive at a fire before it has reached any magnitude.

The foremost manufacturers of fire engines in this country are expending large sums of money in an endeavor to perfect a type of motor engine for fire department use; they promise at an early date an engine that will equal in capacity the second size fire engine.

One of the most important additions to the fire department equipment is the motor propelled aerial truck. This style of truck weighs thirteen thousand pounds, on account of this great weight it has not been practicable to fully secure the service intended for the truck when horse-drawn, motor propelled it has given satisfaction and fulfilled every requirement. A motor propelled chassis attached to a fire engine is another improvement now being experimented with. From reports obtainable it is proving satisfactory.

The speed at which automobile fire apparatus should be driven when responding to alarms, is a matter that should be given careful consideration when preparing regulations governing the operation of same. There have been numerous accidents and loss of life on account of the high rate of speed at which the apparatus has been driven through the congested districts of cities. For safety the automobile should never be driven at a greater speed than 25 miles per hour in congested districts and 30 miles per hour in the outlying districts. Speed can be greatly reduced, however, in the congested districts and still retain supremacy for the automobile apparatus.

The advent of the motor propelled apparatus into the fire fighting business indicates the early reorganization of the personnel of the stationing of apparatus in more centrally houses.—*Pacific Municipalities.*

GARBAGE AND REFUSE

A Foreign Street Sweeping Machine—Pittsburg's Garbage Problem

A Foreign Street Sweeping Machine.

The idea of an automobile-propelled street-sweeping machine is by no means new, but the application of the suction principle to an automobile street-sweeper in Vienna is distinctively novel. The machine referred to is described in a recent issue of the German paper, *Technische Rundschau.*

The construction principle of the machine is as follows:

The cylinder brush which is confined in an iron covering, is manipulated by a motor with chains, and hurls the sweepings against the small opening of a suction funnel, with which a very powerful ventilator is connected.

Through this ventilator a current of air is produced, of which the entrance velocity out of the so-called suction opening amounts to some 98 feet per second. This enormous current of air takes up all the sweepings which are thrown against it. In this way not only the small dust particles, but also the moderately large gravel and loose stones are drawn with it. The mixture of dust and air passes the ventilator and goes through a passage into an especially constructed chamber where the air and dust are separated from each other.

The separated dust falls through an opening on the floor of the chamber into an elevator which elevates it and deposits it in two iron tanks, which are provided.

When these are filled they are taken out either by motor or by hand, empty ones are set in, and the sweeping continues. The capacity of these receptacles amounts to some 2 cubic yards, which means a weight of about one ton.

Since the air is never entirely free from dust, it can not be allowed to return out into the open, but must against be taken back through the brush.

Through this arrangement the difficulties present themselves at the beginning since the opposing air-current owing to its marked velocity of 40 feet per second has a very damaging effect upon the suction and upon the compactness of the machine.

Through an especially patented device, it has after much effort become possible not only entirely to relieve the damaging effect, but make use of it.

Through this achievement is secured in the machine a constant air volume which remains in revolution, and which serves solely as a means of transportation for the sweepings and the air cannot possibly leave the machine.

The exchangeable receptacles in the wagon can, as has been said, take up 1,000 big sweepings, which, by the way, reaches the standard amount of 1,050 to 2,000 feet of street surface. After the sweeping of which the receptacles are changed.

Operating at the average rate a machine can, in five or six hours' work, sweep 70,000 feet of street surface and collect the sweepings. In doing so the service of only one man is needed, since all the manipulation-levers are within reach of the driver.

The dust boxes which have already been filled can, by means of an automobile suitably constructed for heavy work, be collected, and taken outside the city limits.

This kind of street cleaning makes possible a rational disposal of the refuse, since the sweepings can be collected by machinery into a convenient sized box, which can be easily and quickly transported by the transportation automobile to a burning establishment.

In conclusion it may be mentioned that it is possible by keeping up a slanting position of the brush to use the machine in rainy weather. It is only necessary to stop the ventilator, then raise the covering of the brush from the ground sufficiently by means of a simple hoisting contrivance, so that the brush remains upon the ground. Then the cleaning goes on in the usual way.

The new system is especially profitable, not only on account of its hygenic qualities, but also on account of its economical advantage of eliminating almost all the after-work which is done by hand. The community of Vienna, for example, would by strict carrying out of this system on the street area, with forty machines, save some $60,000 annually.

The Pittsburg Garbage Problem.

Dr. E. H. Walters, director of the department of public health of Pittsburg, has prepared a report on the disposal of garbage, rubbish and other waste in the city. The report will be used by council as a basis to work out the problem of spending the $100,000 which was voted in the bond issue of November 9, 1910, for the construction of an incinerator for the destruction of such waste.

The collection and disposal of the city's garbage at the present time is taken care of by the American Reduction Co. and the Allegheny Garbage Co., at an aggregate

cost of $253,500. These companies have reduction plants at West Newton and one at the head of Herrs Island. The garbage is reduced at these plants and the fats collected. The residue is used as the basis for fertilizer. The solder is collected from the old tin cans and the tin is bricketed. There is a great amount of wet garbage to be disposed of by reason of the fact that gas is used almost exclusively for cooking, and therefore the householder does not dispose of the kitchen refuse by burning, as in many other cities.

In order to make an intelligent estimate regarding the quantities to be disposed of, it was decided to make collections of a ward for a few months. The American Reduction Co. offered its services to make such a test collection. The Fourth ward was decided upon in which to make these collections, and in June and July, 1909, the residents were notified by the sanitary officers that for this period the city would collect and dispose of all rubbish. They cooperated with the city officers and the result was that a very accurate accounting of all rubbish collected, as follows:

New fourth ward collections, estimated population, 30,000; number one-horse loads hauled, 209, or 141 tons; two-horse loads hauled, 116, or 138 tons; totals, 325 loads, or 279 tons; average loads per day per one-horse wagon, 3; average loads per day per two-horse wagon, 2; average weight per one-horse load, 1,345 pounds; average weight per two-horse load, 2,396 pounds; average daily accumulation of rubbish per inhabitant, 3,054 pounds; estimated daily accumulation of rubbish for 567,000 inhabitants, 173,162 pounds, or 87 tons; estimated accumulation of 567,000 inhabitants per year, 83,204,057 pounds, or 31,602 tons.

In making his investigations Dr. Walters visited a number of cities, where he inspected the garbage disposal facilities. These cities, which included Cleveland, Buffalo, Chicago, Baltimore, Milwaukee, Minneapolis, Philadelphia, New York, Boston and Washington, gave data on operating cost which Dr. Walters summarizes as follows:

The operating cost of incineration in American cities is variously reported from 23 cents to $2.46 a ton of waste destroyed, exclusive of interest, depreciation and sinking fund charges. The additional fuel is coal and the quantity required varies from 63 pounds to 240 pounds a ton of waste. No city is reported burning garbage or other refuse without additional fuel except by mixing ashes and thereby obtaining benefits of the unburned coal in this form of municipal waste.

The cost of equipment and buildings for an incineration plant for Pittsburg, where there are 110,000 tons of mixed garbage and rubbish per year, or 353 tons per day, at $1,000 per day ton capacity, exclusive of cost of land, would be $353,000. The destroying of street sweepings has not been considered, as the destruction of them by incineration is not considered practical by me.

Dr. Walters suggests the following plan for Pittsburg:

The plan I suggest is one evolved by this department, with the assistance of Mr. Sprague, of the bureau of construction, in which it provides for one central plant and the placing of docks or collecting stations along the river, where barges will receive the rubbish and it will be transferred to the plant, located on city's property in the lower North Side. This plant could be so constructed that in the event of the city deciding to destroy its garbage in connection with the rubbish, the plant could be used as a unit, or enlarged so that it could take care of the collection of the entire city.

As to the cost of this plant, I will give you the facts as briefly as possible:

Ten barges, 10 docks, 1 tug, complete	$ 25,000
Receiving dock, with hoist, conveyors, etc.	7,000
Three furnaces at $10,000 each	30,000
Chimney, etc.	5,000
Building	20,000
Conveying machinery and miscellaneous equipment in plant	2,500
One boiler, generators and motor for handling refuse and for lighting plant	10,000
Total	$100,000

This estimate could be cut down at the present time by using one-half the number of boats and docks, which would be five boats, five docks and forty baskets, making the estimate for the plant $85,000. This, I think, would be sufficient to start with. Other boats and docks could be added as the demand required.

The docks alluded to probably will be pile structures, constructed as inexpensively as possible. They will be provided with timber chutes and hoppers to discharge directly into pontoon boats. The cost of these docks will be about $500 each. The pontoon boats will be of timber about 60 feet in length, 12 feet width and provided with compartments for holding iron buckets, which will be 12 feet long, 77 feet high and 6 feet wide. A barge of this character has been estimated on data secured at $1,000 each. The steel buckets will probably cost between $150 and $175. In the estimate the number of buckets will be approximately 80, and the number of barges 10. The estimated cost of the tug with sufficient power to move these barges would be $5,000.

STREETS AND STREET RAILWAYS

English Use of Tar As a Dust Preventive—Systems for Marking Street Cars—Report on St. Louis Railways—Milan's Electric Plants.

English Use of Tar as a Dust Preventive.

The report of the U. S. consul at Hull, England, makes note of the use of various tars as dust preventives by that city. Gas oil tar, applied as a fine spray, refined oil, delivered to the machine while hot and applied by sprinkling, and a mixture of paving tar and pitch, heated and applied with a brush, were the materials used. The latter material was said by the city engineer to be the most effective as regards dust prevention and road preservation, but by reason of the delay in heating and the comparative difficulty of applying, it was also said to be the most expensive.

On complaint being made that the treating made the road surface slippery for horses, the city engineer prepared a report which is abstracted briefly as follows:

With regard to the streets treated with gas oil tar, which comprise about two-thirds of the total mileage, it does not appear that any complaint has arisen, although it is possible that trouble might occur if the tar was applied over a smooth non-absorbent patch.

Probably most of the trouble has arisen from the use of coal tar from the large machine. It is the practice to follow up the machine when necessary with sand, but it travels over the ground at five miles per hour, and it is quite possible that small areas might either not be reached in time to prevent accidents, or might even be overlooked, especially if a shower of rain follows the application. It does not appear that any of the trouble is likely to arise if the road is in a clean and absorbent condition, but the condition of macadam roads is, of course, far from uniform, and a small area which has been disturbed for a trench, or wetted in any way, or previously heavily tarred, might not absorb the new tar for many hours. The supply of this coal tar is somewhat limited, and it is proposed in future to use it only for the first journey in each day, so that it shall have as long as possible to absorb before dark, and no doubt drivers are now realizing the risk of traveling on wet tar.

As regards the third method of treatment, it is confined to such a small area at one time, and the work is so obvious that there is no excuse for drivers going upon a dangerous area, especially as the tarred surface is sanded whilst still hot.

The permanent effect on the surface has, of course, to be considered, and no doubt anything whatever of a tarry nature applied to a road surface will slightly impair the foothold. The city engineer has communicated with a large number of firms and submits their replies. It may be said that the attitude of the cab proprietors varies from indifference to strong hostility, and that the heavy carters are apparently indifferent. Messrs. Greenwood Brothers state that although there are some disadvantages to horses by causing them to slip and detract from their power, they are outweighed by the benefit to the general public. Mr. Isaac Taylor, the secretary of the Cowkeepers' and Farmers' Association, states that there have been numerous complaints, but that in places where the tar has been thinly applied he thinks it a great benefit.

Complaints have arisen from two other causes, namely, spray from the large machine having been blown on to property or person's dress on a windy day, and in two instances through tar being splashed from puddles where water had been standing when the machine passed through the street. It is fair to say, however, that considering that the length of streets treated must be at least 50 miles, the complaints have been relatively few, and bear no proportion to the appreciation which has been expressed by the general public.

Considering the area to be covered and the dependence of the work upon the weather, tar treatment has now to be considered as high-speed emergency work, and some trouble must inevitably arise from work carried out under these conditions, but with the increasing experience of the men engaged upon it, it may be expected that complaints will become still fewer in number.

Systems for Marking Street Cars.

In the average American city the methods of designating the routes of cars is far from satisfactory, and often confusing to a marked degree. It is customary to place on the front and sides of the car the name of one of the streets which it travels in covering its route. This name indicating as it does only one of perhaps six or eight streets through which the car passes, is particularly misleading to those who may be unfamiliar with the city.

Attention has been called to the Vienna system of designating car routes, a system which is used extensively in Europe, particularly in the German cities. Large let-

ters are placed on the forward end of the Vienna cars, indicating and distinguishing the routes. These letters, which are interchangeable and illuminated at night, seem to make getting about town easier, particularly to the visitor and foreigner, who is not familiar with the city. There is a further advantage in that the car can be identified from a distance, which is often difficult with the naming system. This matter while it seems trivial, is a means of saving a great deal of time, as a passenger will frequently stop a car before discovering that it is not the one he desires.

The system is very commendable and is greatly superior to the usual methods followed in America, but in at least one American city a system has been devised which is an improvement over Vienna's plan. The Boston elevated railroad is at the present time trying a system of car signs which, should it prove popular with the patrons of the road, will be generally adopted.

In former years the cars were identified by colors, but the system became so complicated that it was decided to adopt the system used in European cities or an improvement on it. The numbering system was the result.

Four large signs are placed on the car. Two in the front and back, well upon the hood, and two on the sides. The front and back signs are fifteen inches high and five and one-half feet in length. On the right half of the sign are three figures. The first represents the division or section of the city to which the car goes regularly. The second and third represent the route by which the car proceeds. For a number of years the different sections of Boston have had division numbers. For example, Cambridge is known as Division No. 7. Thus if a car is numbered 756, it would mean that the car was a Cambridge car and would reach Cambridge by the route No. 56. Route 56 might mean by Broadway; by Cambridge street, or whatever the road officials decide upon.

Adjoining the figure is the distinction, written in large letters so the passengers cannot make a mistake. When a car is making its return trip a roll is turned, changing the written distinction. On the side of the car is the written route of the car.

Report of the St. Louis United Railways Investigating Committee.

The committee appointed by the city council of the city of St. Louis to report upon various phases of the traction question has recently returned a very complete report and with a number of recommendations concerning the needed legislation upon a number of points.

One of the first recommendations of the committee, was that concerning the routing of the cars. At the present time the ordinance requires that all cars shall be operated to the end of the line, and return. Owing to this fact, and although there are more cars in operation than the law requires, in fact more than the provision relative to the minimum distance between cars will allow, there is great evidence of overcrowding during the rush hours. To remedy this, it is recommended that some of the cars be "short routed"; that is, allowed to make a loop short of the end of the line, during the rush hours. These cars are to be plainly marked to distinguish them from the "long route" cars.

The committee found that the system of transfers as established by the United Railways Company was such as to necessitate in many cases unnecessary travel of several miles, with the consequent loss of time, or the payment of an additional fare. The rules established by the company respecting transfers were violative of the spirit and the contemporaneous construction of the provision of the Central Traction Company ordinance respecting transfers. The company contended that it was complying with the ordinance if it offered a "continuous" ride and gave one transfer. In many cases the rides were, in fact, too "continuous," causing long hauls of the passengers. But long hauls, as all street car transportation experience will prove, are unprofitable to the company itself. If the abuse of the transfer rights of the passenger is eliminated, the company is in a better position to offer a more liberal system of transfers. The conclusions of the committee on this point are embraced in the ordinance introduced with the report.

The provision of the ordinance relating to the transfers is as follows:

Said company shall issue transfers, or a coupon transfer equivalent to such transfers, as the company may elect, to each passenger paying such cash fare and demanding the same at the time of paying the fare, so that such passenger may travel for one fare from any point on said company's system of railway to any other point thereon, by connecting car, within the present limits of the city of St. Louis by the most reasonable and practicable continuous direct route; provided, that the company shall not be required to issue more than one transfer if one transfer will enable the transportation of the passenger as aforesaid.

Provision is also made to prohibit the selling, giving away, or improper use of these transfers.

One rather unique provision of the ordinance reported by the committee is that providing for a supervising board known as the Board of Street Railway Supervision. This board is to consist of three members. The first of these members is to be appointed by the company, and is to receive from them a salary such as they may desig-

nate. The second member is to be appointed by the mayor, and is to receive a salary of $3,000 per annum from the city. The third member is to be chosen by the two first named members and is to receive a salary of $3,000 per annum to be paid in equal parts by the city and the United Railways Company. The members named may be removed at any time by the party who appointed them.

The duties of this board will be as follows:

To hear and consider complaints made against the United Railways Company that it is not observing the terms and covenants of its franchise or contracts, or such general ordinances as have been or may hereafter be enacted under the powers of the city to conserve the health and safety of the public; also to hear and consider complaints regarding the selling or giving away of transfer tickets, or coupon transfer tickets, issued by said company, or improperly using or attempting to use the same, or evading or attempting to evade the payment of fares on its street railway cars, or jumping on or off the cars while in motion, or hanging on or riding on any part of the outside of such cars, and to do and perform such acts and things as have been mentioned in the preceding sections of this ordinance; and also to recommend after investigation, and upon written report to the mayor, such amendments or changes in such ordinances or police regulations as may appear to said board to be advisable.

In addition to these matters, permission is granted to construct a number of lines of track, a settlement is made of the differences regarding the amount of tax assessed by the city, and a number of questions relating to the better operation of the cars are settled. The report shows a careful and full investigation of the problems offered; and is clear and concise in its conclusions.

Milan's Municipal Electric Plants.

The report of Vice Consul James B. Young from Milan, Italy, contains a very interesting account of the water power stations which the city of Milan is completing. These stations, five in number, are located in the Alps and with one steam-power station in Milan form an electric lighting plant, the cost of which is about $6,485,000. With the completion of the plant the present gas street lighting system will be replaced by an electric system.

In time the city will be able to extend the application and use of its electricity and enjoy the benefits therefrom, but at first the project only contemplated furnishing the public streets with illumination, running the city water works and distributing the water, and later supplying private persons and companies with light and power.

Power derived from the mountain streams in the upper Valtelline Alps at Grossotto and thereabout is conveyed across the country for more than 93 miles to Milan. At first a power of 65,000 volts and 27,000 kilowatts wil be derived, but this will be increased later to about 72,000 volts and 50,000 kilowatts, and the 40,000 horsepower will be increased to about 60,000. Two estimates of cost were made. The first contemplated an expenditure of $4,537,430, but this was found too small after the original plans had been enlarged, so a second estimate was made as given above. Power from the plants will be carried to Milan under the form of triphase electrical currents, and the city figures on furnishing to the users about 24,400 kilowatts. The estimated running expenses will be $772,000 a year, or slightly less than 12 per cent of the capital invested. Total receipts have been estimated at about $864,040 a year, which would give the city an annual profit of $92.040.

The estimated cost of the several plants is as follows: Grossotto, the principal station, $1,351,000; Roasco, $231,600; Mazzo, $289,000; steam central, $752,000. Up to the present work has been confined to the construction of the steam plant and the Grossotto central station, the city having deemed it advisable to construct the Tirano and Le Prese plants later, in order to devote more attention to perfecting the municipal management, and to securing the market for electrical energy.

The city also deemed it advisable to connect the Roasco and Mazzo plants with the the energy derived from these two small the energy derived fro mthese two small falls without increasing the expense of the line of transmission, etc., and when these two are built the tension will be increased to 72,000 volts. The distance between the Grossotto plant and those at Mazzo and Roasco being short, the current from these two will be conducted to the Grossotto plant at 10,000 volts, at which tension it is produced, to be transformed by means of step-up transformers to 65,000 volts. Energy produced at Tirano and Le Prese will be transformed to 65,000 volts in the plants where produced, instead of at Grossotto, but afterwards conducted at high potential to Grossotto.

At Milan the current will be lowered by step-down transformers to the same voltage as the current produced in the steam plant, through which the current will enter the city. At a tension of 8,650 volts the current is to be put in the city's circuit, which will carry it either to the rotary transformation central, in Milan, for transformation into continuous current for public arc-light illumination, or to the numerous substations of static transformation, in

which the current becomes reduced to 160 volts and enters the city's system of secondary wires that will carry this current to consumers.

The project includes, therefore, five water-power plants, one steam-power central station, and a receiving and transformation station in connection therewith; the transmission wires from Grossotto to Milan, including 120 substations along the line; the city distribution system; converter station, and the public illumination service.

To bring the power line to Milan 1,710 poles of trellised steel have been erected between that city and Grossotto. These poles required about 4,000 tons of cement for foundations, while some 660 tons of copper wire were used. There is a double row of poles, which are 65½ feet high, weighing 2,866 pounds each, at intervals of 656 feet. The insulators are 15½ inches tall, weigh 50½ pounds, and have a diameter of 15.2 inches.

In anticipation of the expiration of the contract of a large private Italian electric power company (La Societa Edison di Elettricita), which enjoyed a monopoly in furnishing electriciiy for light and power to the city of Milan, the city itself decided to go into the electric-power business and supply its own needs, and, later, the people's as well. The city's contract with the Societa Edison expired December 31, 1904. The communal consiglio of Milan, with this in mind, on December 28, 1903, voted the construction of a municipal power plant, and in connection therewith the immediate construction of a central station at Milan to use steam until the water-power plants could be completed. This generating station, using steam power, has been in operation since June, 1905. Already the city's competition has resulted in a reduction in the prices of electricity charged by private companies.

MUNICIPAL AND TECHNICAL LITERATURE

Books for Engineers.

Wrought-Pipe Drainage Systems. By J. J. Cosgrove. Cloth, 145 pp. Standard Sanitary Mfg. Co., Pittsburg, Pa.

This is another of the practical books on plumbing, written by Mr. Cosgrove for a manufacturing firm, which is also a publisher to this extent. It describes what was formerly known as the Durham house drainage system, using wrought iron or steel pipe, but which, since the expiration of the patents, has been known to the trade, at least so far as the fittings are concerned, as "recessed drainage fittings." The first chapter discusses the differences between steel and wrought iron pipe, the strength of the pipe and its seams, and the various sizes, weights and dimensions. The other chapter describes methods of working wrought pipe, tapping, jointing, reaming, etc.; pipe cutting and threading tools; types of fittings, ventilation fittings, drainage fittings; binding wrought pipe; making up pipe, including tools and materials; measurements and sketches; planning the work; installing a system, including methods of attachment and support of pipe; working polished brass and nickel plated pipe. An appendix describes the welding of wrought pipes by the thermit process.

Clarification of Sewage. By Dr. Ing. Rudolf Schmeitzner, chemist, Germany. Translated by A. Elliott Kimberly, consulting engineer, Columbus, O. 114 pp., cloth, $1.50 net. Engineering News Publishing Co., New York City.

This is the first opportunity that American engineers generally have had to obtain information about the numerous methods of clarifying sewage which have been developed in Germany. English practice has been quite well shown in this country and, under the pressure of state boards of health, English methods of purification have had the most frequent application. There are many places in this country where the German processes described in this book are sufficient, and there are many others where it would seem that they could be substituted for portions of plants which have not proved entirely satisfactory. The translator has recognized this and so presents this brief but comprehensive survey of the field from the pen of one who has had an opportunity to inspect fifteen of the larger German clarification plants and whose ability to observe and criticize is amply shown in the text.

The analysis of each step in each process is carried through according to an introductory schedule of requirements and details of construction and operation are clearly classified in reference thereto.

The design of clarification plants is considered as to site, constructional details, intermittence or constancy of operation, change in character of sewage, protection of operators, nuisances, etc.

Other chapters treat composition of sewage; the component parts of a plant, such

as screens, gratings, scrapers, openings, moving screens, grit chambers, sedimentation devices, sludge removal apparatus, etc., with a statement of the principles of design, and sedimentation towers; sludge removal and treatment for recovery of by-products, apparently not a profitable operation; practical arrangement of clarification and purification plants. A list of full de-descriptions of numerous plants and their location in German publications ends the book.

All who are engaged in the design and re-design of sewage disposal plants will find much valuable material in this little book.

Vitrified Paving Brick. A review of present practice in the manufacture, testing and uses of paving brick. By H. O. Wheeler, E. M., formerly clay specialist of the Missouri Geological Survey. Paper 121 pp., $2.00. T. A. Randall & Co., Indianapolis, Ind.

This is the second edition of a book which has been for fifteen years the standard, if not the only fully reliable book, covering its subject. The addition of about thirty pages and a careful editing of the former edition to bring into it the advances during the years since it appeared, bring the book down to date and keep for it the position of leadership which the first edition immediately assumed. The principal additions are the complete description of the standard rattler, absorption and crushing tests, the N. B. M. A. standard method of conducting the rattler test; a number of descriptions of other kinds of pavement, such as macadam, wood, asphalt, stone blocks; methods of comparing values of pavements; data on life and cost of brick pavements, tables of results of tests; the St. Louis specifications for brick paving, including forms of contract and bidding blank; and the National Paving Brick Manufacturer's specifications for laying paving brick.

The Prevention of Industrial Accidents, No. 1, General. Prepared by Frank E. Law, M. E., and William Newell, A. B., M. E. Paper, 196 pp., 25 cents. The Fidelity and Casualty Co., New York City.

After a brief chapter on the general precautions to be taken by employers and employees in preventing accidents, the authors take up the safety devices that have been invented under the general headings of steam boilers, engines, electrical apparatus, elevators, the factory in general and wood-working machinery. Special industries and their particular devices are treated in separate pamphlets.

The uses of the devices described are given in considerable detail and the book is most valuable for those engaged in mechanical pursuits, and will give the engineer many pointers on the safe operation of plants which he may be called upon to design.

Sewage Disposal. By Leonard P. Kinnicutt, C. E., A. Wilslow and R. Winthrop Pratt. Cloth, 462 pp., $3.00 net. John Wiley & Sons, New York City.

This triple authorship makes possible a general survey of the field of sewage disposal from all points of view, for Professor Kinnicutt is a professor of sanitary chemistry and has been the consulting chemist of the Connecticut Sewage Commission; Professor Winslow is in charge of the biological work in the sanitary research laboratory and sewage experimental station of the Massachusetts Institute of Technology, and Mr. Pratt is the chief engineer of the Ohio State Board of Health and was at one time director of sanitary engineering in Cuba.

The introduction discusses the sanitary demand for sewerage and sewage disposal. The chapters take up the composition of sewage, disposal by dilution, screening and straining, preliminary treatment by sedimentation, by chemical precipitation, and by the septic process, disposal of sludge, purification by broad irrigation and sewage farming, by intermittent filtration through sand, in contact beds, on trickling or percolating beds, disinfection of sewage and sewage effluents and analysis of sewage and effluents.

Results of the classic experiments in America and of the application of their principles in the treatment of city and town wastes are given in reasonable detail. The point of view is always that of the scientific investigator, the technical observer, rather than the practical designer and constructor. This is fortunate in one sense, because the young constructing engineer is likely to be restricted in his view and to put too great emphasis on the particular kind of work he has done. But, the designer, looking for guidance in detail will find himself lost, sometimes, in the wealth of material, concerning the choice of which he finds little or no direction. Again this is fortunate in a sense, because the variety of detail is evidence of the fact that the experimental stage is still passing and if the reader were led too definitely into any one line he might find that he would be misled, the conditions in his own case being such that that course would not lead to success in his case. He must, perforce, work out the problem for himself, by steady experiment, and will find the book of value because of its breadth of view and variety of practice.

There are some omissions in the early history and the demonstrations of some of the theses advanced are somewhat too brief to be entirely convincing, but the book meets a need that has been felt ever since Rafter and Baker's big book got out of date, and will be a good basis for a number of monographs or books on details of design and construction, which will doubtless appear when practice becomes somewhat less experimental and a plant is built which is not outgrown before it is put in operation.

CURRENT INFORMATION

Wood Block Pavement Recommended for Chicago Streets.

Charles K. Mohler, consulting engineer for the Loop Protective and Improvement Association, has presented a report regarding the use of creosoted wood block paving in the central business district of Chicago. In his introduction to this report Mr. Mohler states that the pavements in the business district of Chicago have for years been almost intolerable. Among the defects noted are: Rough and uneven surface; noise from traffic; dirt and dust; difficulty and expense of cleaning, and slippery surface of blocks.

In outlining the requirements for the ideal pavement for heavy traffic, the following requirements are noted:

First. That the pavement should have a surface that will give sure footing to animals and a firm grip for motor vehicles, to secure the greatest tractive effort, under all conditions.

Second. That it should have a smooth, even and uniform surface, of such character as to offer the least resistance to vehicle traction.

Third. It should be durable and possess uniform wearing qualities.

Fourth. It should be noiseless from the effect of hoof strokes, the wheel contact on the pavement itself or induced rattle and vibration set up in vehicles passing over it.

Fifth. It is desirable that it should be not only clean itself, but easily cleaned of any refuse or litter coming upon the roadway.

Sixth. It should require a small amount of crowning and form a water-proof surface.

Seventh. It should be easy of repair.

Eighth. It should be of such character as to give the most satisfactory construction where junctions have to be made with such obstacles as street railways, manhole covers, etc.

Ninth. The cost should be reasonable.

As regards the use of creosoted wood block pavement which Mr. Mohler states to be the nearest to ideal for the loop district, the following are the recommendations noted:

TIMBER.

The kinds of timber best adapted for the manufacture of the block does not seem to be well settled. Long leaf yellow pine has probably been most extensively used. Tamarack has been largely used in Minneapolis, and I believe with quite satisfactory results. Black gum is quite extensively used in some localities. Almost any sound wood with the required amount of crushing strength may be expected to give good results when properly seasoned, treated with preservatives and well laid.

TREATMENT.

The amount of creosote oil per cubic foot of timber called for by the Chicago specifications is sixteen pounds. Some cities require from twenty to twenty-two pounds per cubic foot. My judgment would be in favor of the larger amount or all that can be forced into well-seasoned timber under the best method of treatment. The reason for the higher degree of impregnation is to exclude water or moisture to the greatest degree possible. That should be done for two reasons:

First. With the absorption of moisture the blocks swell an objectionable amount and then shrink when dried out.

Second. Wood has much greater crushing strength when well seasoned and dry than when damp or wet.

If the blocks absorb too much water there is danger of them swelling to the extent of bulging the pavement. When soaked with water or even damp the blocks become soft and will crush and broom under traffic much more readily than if thoroughly dry. A wet block will have about one-half the crushing strength of one well seasoned and dry. That is probably why the destruction of wood block pavement is comparatively rapid when rutting and brooming is once started. For heavy traffic streets a much lighter charge of preservative would be effective if only provision against decay were required. With the heavy charge of oil there will be more of what is termed sweating or bleeding (oil oozing from the blocks). In damp weather that leaves the surface of the pavement more or less "smeary" and "greasy." Until the pavement has aged sufficiently to quit sweating, the difficulty may be largely remedied by spreading clean, sharp sand or gravel over the surface when conditions require.

OIL.

As above stated, one of the most essential requirements of the preservative is that it shall exclude moisture from the blocks. In fact, for such pavements as we are considering the exclusion of moisture to the fullest degree practicable, to keep the wood dry and hard and wear resisting, becomes, if anything, the factor of prime importance. This is especially the case when tall buildings are on each side of the street and the elevated structure in the center of the roadway, leaving the pavement in shadow practically all the time. More particularly is this true at points where it is covered with stations and platforms. The pavement will unquestionably be damp and wet most of the time. Such being the case an oil with a high specific gravity is to be preferred. Asphaltum oil or pitch might give good results.

LAYING.

An ideal or wholly satisfactory method of laying the blocks seems not to have been devised. Longitudinal and transverse expansion joints have been commonly employed when the blocks were laid on a sand bed with sand filler to prevent bulging when the blocks become heated or water soaked. To my mind both transverse and possibly to some extent longitudinal expansion joints are objectionable for two reasons:

First. If the joint closes up the row of blocks on each side usually are pushed up enough to form a ridge across the roadway.

To this rise in the blocks is added the pitch that is squeezed out of the joint.

Second. If the joints do not close up then the pitch is gradually worn out from between the rows of blocks and a rut left the entire width of the roadway. This is subject to rapid wear and increases by calking of horses' shoes and pounding of wheels on the exposed edges of the blocks. When the blocks are set in mortar, expansion joints cannot be introduced. When used in conection with the sand bed there is the objection that, when adjoining blocks of different height are brought to an even top surface, the bedding of the blocks may be too much disturbed when the blocks can move laterally. On account of the arch or crowning of the roadway cross-section from which heaving or "exploding" may result when expansion takes place and from the fact that the longitudinal expansion joints are in the gutter and subject to little wear, there is more reason for and less objection to their use than there is for transverse expansion joints.

The aim should be to get the blocks so laid that they will remain exactly in the position in which they are placed regardless of traffic movement, weather conditions or temperature changes.

LAYING BETWEEN THE RAILS OF THE CAR TRACK.

Perhaps one of the most aggravating obstacles to securing a uniformly good and even roadway surface is the street railway tracks. The paving inside the tracks and the outside junction with the rails is hardly ever found in good condition in a comparatively short time after laying.

The paving between the track rails is subject mostly to the calking of horses' shoes. This is especially aggravated at points where the tie rods are located. A pavement on which can be seen much of the bad effects of this kind of wear may be found on Dearborn street, between Madison and Jackson. Wherever a tie rod occurs the spacing is apt to come out so as to require thin or narrow closures. Some of the narrow closure work was especially noted on the track laying on Monroe street between Clark and Dearborn during November, 1910.

It is believed that more satisfactory results might be had in the track paving if the tie rods were turned flatwise and thoroughly bedded in mortar so as to form a part of the paving bed. With a three or three and one-half-inch paving block the tie rod space or break could be eliminated by laying the blocks continuously over the tie rods. As previously stated, the greater portion of the wear in the track paving comes from the calking in the transverse joints. By laying the blocks lengthwise of the track the number of transverse joints would be reduced by fully one-half. In addition to that, those that do occur would be broken. I know of no case where these expedients have been tried. It is believed that some such method should be given a thorough test at least to prove or disprove the theory. While the property owner does not foot the bill for the track paving, he certainly has a vital interest in the character of the roadway as effected thereby.

The depth of blocks used in track paving in New York is three inches.

PITCH FILLER.

The pitch filler is the element that is in a large measure responsible for the dirty and objectionable features of block pavement in hot weather. The condition is usually aggravated when damp weather prevails. When it is recognized as a condition to be met and taken care of in the proper way it should not be serious. In damp weather the moisture is absorbed causing the blocks to swell. The heat softens the pitch and helps to expand the blocks, causing the pitch and oil to be squeezed out to the surface.

As previously stated, this difficulty can be pretty well taken care of by proper sand dressing, or possibly scraping off the excess ooze on the lines of pedestrian travel. By the use of the sand and gravel dressing and rolling it into the pitch a thoroughly waterproof wearing surface is formed of tar or asphalt pitch, sand, dust, etc., to take up the wear of traffic and thus preserve the block surface for a longer period.

In this connection it is believed that an asphalt pitch might be used to advantage over tar pitch. It does not get soft and flow as readily in hot weather and does not get as brittle in cold weather. It also has the added advantage that it does not stick to the feet and track about like tar pitch.

Pitch filler should obviate any possible demand for transverse expansion joints, and possibly longitudinal as well.

SAND FILLER.

Sand filler for the joints has been used on a number of the downtown Chicago streets. Owing to the fact that sand-filled joints allow free access of water all around the blocks, and that sand has no elasticity, I do not believe it is a desirable material to use for a filler.

PITCH AND SAND FILLER.

There may be some advantage to be derived by the use of a pitch and sand filler. That method would consist in filling the lower half of the joint with pitch to give a water-tight joint, and the upper part with sand to take up the excess of oil or pitch to give a cleaner surface.

TOP DRESSING.

To get rid of the bad effects of excess pitch and creosote on the surface, and also render the pavement less slippery, it is recommended that a thin even layer of gravel be spread over the surface (either before or after the sand dressing has been applied, as experience may prove to be the better) and well rolled with a heavy roller. By such treatment the grains of the gravel will be forced into the excess pitch, bedded into and between the blocks, and forms a wearing surface of the pitch creosote which might otherwise become a nuisance. It would also produce a surface that is much less slippery than the bare treated-wood surface. In fact, it may, and probably would, remove the objections of slippery and smeary surface altogether. The size of grains in the gravel to range from ½ to ¼ inch in diameter. A granitic gravel should be preferred to secure greater durability.

Paving Reforms in Manhattan.

Borough President McAneny, of Manhattan, has had engineers at work for several months examining and experimenting with types of permanent paving. Mr. McAneny agreed fully with the criticisms which have been turned so frequently of late upon the New York pavements, and he said that within a short time he expected to present to the board of estimate recommendations for a general replacement of the old type street pavements.

The old asphalt pavement was laid upon cobblestones, and these have worn through to the surface and broken into holes. The asphalt is little more than a carpet, and under the pressure of traffic is bound to follow the contour of its foundation. For the last year or two whenever an asphalt pavement has been laid in the city, it has been placed on a concrete foundation.

One of the difficulties of the situation at

present is the fact that the city has no asphalt repair plant of its own. It has had to rely on the services of private companies, and it is often necessary to threaten suits in order to make the companies fulfill their obligations. Mr. McAneny recently recommended to the board of estimate that an appropriation be made for the establishment of a municipal repair plant. He is of the opinion that the contract system, especially with the long-term contracts of from five to fifteen years, now in vogue, will always prove unsatisfactory for repair work.

One of the complications which the borough officials must meet is that many of the streets and squares are known as "park streets," and are taken out from under their jurisdiction and placed under that of the park department. Columbus Circle, Central Park Plaza and Mail street, at the postoffice, for example, belong to this group. Then there is a further division of responsibility between the city and the street railway companies, while the river front streets, including the full length of West and South streets, are under the dock department. To reach effective results Mr. McAneny believes that all this scattered responsibility should be concentrated in the bureau of highways.

Furnace Clinker as Road Metal.

A new road covering has been adopted by the Kensington, England, borough council. It has, moreover, the advantage of utilizing the clinker residue from the municipal dust destructor.

The method of manufacture is, roughly, as follows: On leaving the furnace the clinker is ground under heavy steel rollers, after which it is mixed with molten asphalt in the proportion of three parts, by weight, of clinker to one of asphalt, a certain quantity of oil being added to the compound.

The resulting viscous mass is then conveyed to a press, where it is cut into chunks. These are subjected to a 100-ton pressure, which turns them into solid blocks of about the same size as the wooden paving blocks used on main thoroughfares in London.

On cooling, these blocks are ready for paving purposes. Their cost in Kensington is $20.50 per 1,000.

So satisfied are the Kensington borough council with these blocks that they have decided to use nothing else on their main thoroughfares. The blocks are of a very durable nature, and their surface is impervious and dustless, so that they should require very little expense to maintain and clean, besides practically settling the dust problem, which has reached an acute stage since the introduction of motors.

The surface for traffic presented by the blocks is resilient and noiseless, and as they are non-porous, is unaffected by weather. The Kensington borough council believe that they have obtained the finest road material possible, and its introduction will be watched with great interest.

Asphalt Block Paving in New York.

There is now in course of construction on the roadway of Thomas street, between Broadway and Mercer street, New York City, a new form of asphalt pavement, which the Mercantile and Financial Times claims to be superior to any other form of pavement hitherto in use, whether macadam, Belgian block, Trinidad asphalt or wood block. This pavement consists of what is known as compressed rock asphalt slabs, laid upon a concrete base, finished on top with a thin "rubber" coating of pure rock asphalt. These slabs are composed of natural rock asphalt obtained from the mines in Travers, in the canton of Neuchatel, Switzerland. The rock, after being mined, is ground to powder, which, after having been properly heated, is compressed in special molds under a hydraulic pressure of 3,000 pounds to the square inch. These slabs, when laid, are about ten inches square and one and three-quarter inches in thickness, and are laid upon a concrete base four to five inches in thickness, with a cushion of cement and sand mixed dry, of just sufficient thickness (about one-fourth of an inch) to level up any inequalities of the concrete base, so as to afford a firm and level bed for the slabs. The slabs are laid with the joints as close as possible, in exactly the same manner as tile on a tile floor.

When all the slabs are laid and leveled, the entire surface is sprinkled with water from a sprinkling can, so that sufficient moisture may penetrate through the joints to enable the cement underneath to set. After this, the entire surface of the slabs is covered with a thin coating, not more than one-quarter of an inch in thickness, of pure rock asphalt, heated in kettles and spread over the surface with a wooden float in the same manner as an ordinary rock asphalt sidewalk or floor, and dusted over with a light coating of dry cement, lightly brushed in with a broom. This forms what is called the "rubber" coating, so called from the "rubbery" nature of the wearing surface thereby obtained, which, being composed of pure rock asphalt, the same material as the slabs, forms a comparatively soft yet tough covering, which, while it marks up easily, does not break or wear into holes.

On account of this rubbery character, the surface affords a sure foothold for horses, as their shoes indent the surface sufficiently to prevent any slipping while turning or backing in cold weather, or when the surface is wet or covered with snow.

Contract Work in New Orleans.

The executive committee of the Sewerage and Water Board, of New Orleans decided to recommend to the board that the first work undertaken in the completion of the sewerage and drainage system be the Napoleon avenue canal system, and that the work be let to contractors.

The committee sustained the opinions rendered by City Attorney Moore and Special Counsel Gleason to the effect that under the law the board is bound to advertise for bids, and the board cannot do its own work in completing the sewerage and drainage system.

In connection with the relative merits of the contract system and day labor method Superintendent Earl offered a report, which is in substance as follows:

Experience to date indicates that the board's forces can conduct and organize any construction work as well as any contractor can organize it; that the board can buy as good or better material by contract as cheap or cheaper than a contractor can buy it, and that it can be more certain of getting the character of material and supplies required for the best interest of the work if it is the purchaser direct instead of the general contractor who profits every time he can use a cheaper material.

In the drainage construction the following consideration will show the possible saving to the board by the use of the small contract and force account system rather than the general contract system.

The contractor has to make a bond in a surety company in an amount equal to 25 per cent. of his contract. He has to put up security or collateral to obtain this bond and to pay a premium for it. Unless he is very strong financially this forces him to borrow money to prosecute his work. He has to pay interest on borrowed money and on deferred payments on materials, etc., and to await the completion of his work to get his retainer or final payment, which is 15 to 20 per cent. of the amount of his contract; so that, all told, it will cost him from 5 to 10 per cent. of the amount of his contract to bond and finance it. He will bid for a higher profit, but assume he only makes 10 per cent., and you have a cost to the city above the actual cost of the work of from 15 to 20 per cent.

The contractor will also need a special plant for the execution of his work. He will figure that this plant may never be of any use to him after this particular contract is completed, in which case he must figure the cost of his plant into the cost of the work.

The contractor will understand that the drainage canals to be constructed are dependent upon the existing drainage stations to be kept clear of water; that these stations themselves will be under enlargement at the same time, and if the contractor assumes no obligation for his convenience he will add to his price for the risks of working in cana's which are already in operation and through which the drainage of the city must pass. If the contractor does assume any obligations on the part of the board to do anything specific in relieving his work of water, he will claim that the board has not lived up to that obligation, and seek payment for extra work and damage due to its fai'ure. With two or three contractors working as they must be so that any action at the pumping station which helps one will injure another, there will be still more confusion, and each contractor will be morally certain that he is getting the worst of it.

On large contract work the forces of the contractor are handled to get quantity of work, and the board's forces are there to insist upon quality, and the total of both forces has to be paid for by the Sewerage and Water Board, and this total is larger than it need to be if there is no antagonistic interest of this character to be taken care of.

The board possesses the following advantages in getting cheap and good work: It has no bond, interest on borrowed money or retainer to consider. The contractors' profits are eliminated. It can buy the best material and supplies for the intended use without the restraining influence of the general contractor, whose interest lies in getting the cheapest.

It only costs the board 1 per cent. in loss of interest on its funds, as they are extended. Machinery and plant for construction of one work can be transferred to another of a similar kind indefinitely as works are completed, thus only costing its actual depreciation for any particular work. The board has rights and advantages and consideration from other public departments of the city and from public service corporations which it cannot delegate as fully to its contractors.

The work of sewerage construction undertaken in 1908 by the board because of bids then reported to be 30 per cent. too high has given a good example of what the forces of the board can do in this respect. To December 31, 1910, 80.5 miles of sewers were constructed in this way, and the cost to the board for the work was not over $676,000, including all labor, material, supervision, depreciation on tools, machinery, wagons, stock, etc. Exactly the same items constructed at the prices bid by contractors would have cost $1,055,415.33.

Mr. Earl submitted the following statement for comparison of cost of doing work actually done by the Sewerage and Water Board sewer construction forces, calculated on prices bid September 11, 1907, and rejected because too high:

Cost of 80.5 miles of sewers at prices bid on items:

Area "Y"	$ 479,477.56
"Z"	233,610.93
"27—S"	198,858.80
"28—S"	143,468.04
	$1,055,415.33
Estimated extra work—3 per cent.	31,662.46
Estimated supervision in field —5 per cent	52,770.77
Estimated general expenses	30,000.00
Total cost as above	$1,169,848.56
Actual cost	675,883.86
Difference in favor of construction by force account	$494,514.70
Per cent. in favor of construction by force account	42½

Saginaw's Street Lighting Situation.

An opinion of much importance to the city is that just rendered to the board of trade by Attorney Robert T. Holland, touching the present contract for street lighting and the status of affairs with reference to the possible erection by the city of a municipal lighting plant.

The city last fall commenced the second period of a ten-year contract made with the Bartlett Illuminating Company six years ago for lighting the streets at a price of $60 an arc light per year. The contract was made to cover two five-year periods. Upon the expiration of the first period if neither party to the contract notified the

other of its termination, it was to extend for another five years.

The first five years ended last fall, and neither the city nor the company gave notice of terminating the agreement, so on the face of things the city has entered upon the second five-year period of the contract and is bound by it for something over four years longer.

The fact of the expiration of the first five-year period was overlooked completely by the city, and was not discovered until some months later, when the subject of street lighting was brought to public attention and steps were being taken to bring about its improvement. The question as to whether the contract was binding on the city for the second five-year term, notwithstanding its failure to cancel it, as provided in the contract itself, then arose by reason of the selling out of the Bartlett company to the Saginaw Power Company.

The board of trade, at the same time, took up the matter of municipal lighting for Saginaw, and a committee made a trip to Lansing to investigate the municipal plant in use there. Its observations there were so satisfactory that it came back home favorable to the municipal plant, and the legal phase of the situation was then gone into, this being referred to Mr. Holland for investigation and report.

If the city were bound by the contract for nearly four years longer, the board members felt that it would be too early to take steps toward a municipal plant, but that if it were not, then the matter might be taken up at the present time. There were also questions for the latitude of the city's powers under the constitution and its present charter to build and operate a municipal lighting plant, and these are treated at length in Mr. Holland's brief.

Mr. Holland holds that the contract between the city and the Bartlett Illuminating Co. for street lighting is not legally binding on the city, and may be abrogated by it at any time it desires. He holds that the contract was irregularly made in the first instance and that it has been nullified by the action of the Bartlett Illuminating Co. in selling out to the Saginaw Power Co. in violation of an ordinance which forbade it to sell and provided a forfeiture of its rights and privileges in case of such sale.

Mr. Holland advises the city, however, to proceed with caution in dealing with the Saginaw Power Co., saying that unless carefully handled, the city will, by ordering new lights or in some such way, recognize the assignment of the contract to the Saginaw Power Co., and thereby estop itself from questioning its validity.

He gives the opinion that at present the city's sole source of authority for building a municipal plant is the city charter, and that under it such a plant would not be contrary to the old constitution of 1850. There might, however, be a question unless the plant was built for supplying electricity to the municipality only. He also holds that the city could not now issue the $75,000 bonds voted in 1900 for the erection of a municipal lighting plant.

If the city charter is revised under the home rule act Mr. Holland holds that an affirmative vote of three-fifths of those voting would be necessary to authorize a municipal plant and that women taxpayers could vote.

Proposals to Furnish Water to Richmond, Ind.

The city of Richmond, Ind., is confronted with the problem of providing for a permanent water supply system by reason of a clause in the franchise of the corporation which is at present furnishing water. This clause provides for the purchase of the plant by the city, provided that satisfactory arrangements can be made, and for the termination or renewal of the franchise, depending on the action taken by the city.

There has been in addition to the offer of sale submitted by the Richmond City Water Works, the corporation which at present operates the water works system, a proposition from another company which has been formed for the purpose of constructing and operating a water supply system.

The proposition of the Richmond City Water Works Company is, briefly, as follows:

The city has the right to acquire the plant at any time upon giving notice at least six months in advance in writing. Three disinterested engineers, one named each by the city and company and the third selected by the two, shall be chosen to fix the valuation of the plant and system.

First—The water works shall first pay all expenses of operating said works and system and of maintaining the same in a state of efficiency, including taxes, salaries, expenses of making valuations and all other expenses of every kind and character necessary and proper for the operation thereof.

Second—The water works shall next set aside each year a sum equal to one-half of one per cent. of the valuation of the water works and system and computed in the manner hereinbefore set forth, for the purpose of creating a fund to cover replacements and renewals of the plant, and also for emergencies and accidents. If, at any time, the water works shall determine that the sum so set aside for replacements, renewals, emergencies or accidents shall not be sufficient to meet the expenses, then the water works shall have the right to increase the amount of such fund, and with the consent of the city shall have the right to increase the rates charged for public and private consumption of water, so as to cover the necessary increase in the fund, and the city shall agree to a reasonable increase of the rates.

Third—The water works shall next create a depreciation and extension fund by setting aside each year out of its gross income a sum equal to one per cent. of the valuation of the plant, to be determined as provided herein. The fund shall be used for the purpose of making extensions and for such betterments as shall not be paid for out of the replacement and renewal fund.

Fourth—The water works shall next retain out of its gross income and pay, as the same falls due, the interest on its outstanding bonded indebtedness at the rate of five per cent. per annum, payable semi-annually.

Fifth—The water works shall next retain out of its gross income a sum equal to six per cent. upon the amount remaining after deducting from the total valuation of its plant and system, fixed in the manner herein provided, the total amount of its bonded indebtedness, which remainder is hereinafter called "net valuation;" and said six per cent. so computed shall be paid by the water works to its stockholders as dividends.

Sixth—The amount of the gross income of said water works remaining after all of said payments and deductions shall have been made therefrom, shall be equally divided between the water works and the city, and one-half thereof shall be retained by and shall belong to the water works and shall be paid by it to its stockholders as dividends, and the other half thereof shall be paid and shall belong to the city; provided, however, that in the event the aggregate amount to be retained by the water works as dividends in any year, as hereinbefore provided, shall exceed 8 per cent. upon the "net valuation," to be ascertained as provided in clause five above set out, then the entire excess over the amount necessary to pay the water works the dividends of 8 per cent. per annum upon such net valuation shall be paid and shall belong to the city. If the rates for water service as fixed by this ordinance shall not furnish a net return of 6 per cent. on the net valuation to the water works as herein provided for, the rates shall be increased by the water works, so as to provide for such return.

The plan mapped out by the Edwin M. Campfield Company, the new corporation, and offered to the city in their bid, if the contract is awarded to them, is explained as follows: "To organize a company of $825,000 capital stock, $625,000 of which shall be common stock, non-voting and non-participating stocks, which shall not be sold, but shall be placed in the hands of a responsible trust company, to be purchased by the city in annual installments of $31,000 each until the total of $625,000 of common stock is exhausted. The other $200,000 of stock will be preferred stock and will be the sole voting and participating stock of the company; of this amount the city shall take $50,000 at par, and the new water works company shall hold the remaining $150,000 until the final consummation of the purchase by the city. The money to construct the plant will be raised by a bond issue of $775,000 of 5 per cent. semi-annual interest coupon gold bonds, which, with the $50,000 paid by the city in purchase of the $50,000 of preferred stock, will make $825,000, and equal to the total amount of common and preferred stock. Although the city's interest will be small for some time, it will at once have under this plan a one-fourth interest in the start and a one-fifth control in the management by being accorded a representative on the board of directors, and also a one-fourth share in the profits which the city can apply on its annual payment. The annual payment will be $31,000 for 25 years, which in the time will amount to $775,000, or just equal to the bond issue. The $31,000 will be paid by the city into the hands of the trust company holding the $625,000 or common stock, upon the receipt of which the trust company will deliver to the city $31,000 par value of the common stock, and with the funds take up and cancel the $31,000 of the bonds, which will be made to mature in that amount each year. As the $31,000 paid by the city to take up that amount of bonds is applied on the principal or face of the bonds and interest payable semi-annually will have to be paid by the water works company out of the profits, which will amount to $38,750 the first year and decrease annually to the amount of 5 per cent. on the $31,000 paid off each year. When the entire bond issue is taken up the preferred stock held by the company will be surrendered to the city and the entire plant turned over to the city, providing the city has put in all extensions at its own expense. If it has not then the cost of all extensions made during the period will be added to the purchase price, and the city will have to pay for the same in cash or by bonds or some other plan to be agreed upon between the city and the company. As the city will have one-fourth of the profits from the start, and as there will hardly be any extensions for some years after the plant is completed, and as the income will no doubt increase as the city grows, the city will be able to take care of all extensions out of its own one-fourth profit and have some over to apply on its annual installments. If the city cannot save enough out of its present revenues, a very slight annual tax would make up the necessary deficiency.

A New Water Service for Lacombe, Canada.

Lacombe, Alberta, is to have a new water service. A by-law appropriating $20,000 for the purpose is to be submitted to the people soon and will undoubtedly be approved.

ORGANIZATIONS AND INDIVIDUALS

American Water Works Association.

The Rochester convention of the American Water Works Association held June 6 to 9 was one of the most successful meetings of the organization in numbers and interest. About 250 members were present and nearly 550 registered in all.

The program was of unusual value. Particularly valuable papers, long enough to cover their fields with reasonable fullness were that by Leonard Metcalf, Emil Kuiechling and W. C. Hardy, on "Some Fundamental Considerations in the Determination of a Reasonable Return for Public Fire Hydrant Service"; one by George C. Whipple on "Hot Water Troubles"; one by George G. Earl on "Water Rates"; one by T. Chalkley Hatton on "Wood Stave Pipe"; one by Allen Hazen on "Steel and Cast Iron Pipe." Others only less valuable because less comprehensive were presented practically according to the program printed in the June number of MUNICIPAL ENGINEERING.

Two of the papers presented are printed elsewhere in this number of MUNICIPAL ENGINEERING and still more of the excellent material will be given later.

The entertainment features were largely in the hands of the association of exhibitors which performed a heavy service very acceptably, the number to be entertained being present at a dinner at the lake. No one felt like objecting to such excellent treatment, but there was an unobtrusive undercurrent of feeling that the members of the association were being put under almost too much obligation to their friends the manufacturers of water works supplies without an opportunity to reciprocate or refuse without seeming ungracious.

One most excellent entertainment was furnished by Dabney H. Maury, a former president, who gave an illustrated lecture on the Panama Canal.

The question box was, as usual, an interesting feature, the list of questions having been sent to members in advance so that they were prepared to make their contributions individually to the answers.

Louisville, Ky., received a majority on the first ballot for the next place of meeting.

The following list of officers was elected, there being no contest, except for the presidency:

President, Alexander Milne, superintendent waterworks, St. Catherines, Ont.

First vice-president, Dow R. Gwinn, president water company, Terre Haute, Ind.

Second vice-president, Robert J. Thomas, superintendent waterworks, Lowell, Mass.

Third vice-president, John A. Affleck, president Water Board, Harrisburg, Pa.

Fourth vice-president, George G. Earl, general superintendent Sewerage and Water Board, New Orleans, La.

Fifth vice-president, Theodore A. Leisen, chief engineer water department, Louisville, Ky.

Secretary-treasurer, John M. Diven, No. 14 George street, Charleston, S. C.

Finance committee, H. E. Keeler, chairman, Chicago; Leonard Metcalf, Boston; Charles R. Henderson, Davenport, Ia.

Executive committee, John W. Alvord, Alexander Milne, Dow R. Gwinn, H. E. Keeler, Leonard Metcalf, Robert J. Thomas, John A. Affleck, George G. Earl, Charles B. Henderson, J. M. Diven, Theodore A. Leisen.

Three Cement Shows in 1912.

Three cement shows will be held by the Cement Products Exhibition Co., 72 West Adams street, Chicago, during the first three months of 1912. The places and dates are as follows: New York, Madison Square Garden, January 29 to February 3. Chicago, Coliseum, February 21 to February 28. Kansas City, Convention Hall, March 4 to March 21.

The three shows next year will be so arranged that exhibitors desiring to be represented at all of them may move from New York westward, taking advantage of special freight cars, which will be arranged by the Exhibition Co.

Although requests for space are already being received by the Cement Products Exhibition Co., no applications are considered formally filed until all interested concerns and previous exhibitors are provided with complete information and given ample opportunity to make application for the reservation of exhibition space.

The Technical Schools.

The April number of the bulletin of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., contains the description of courses of instruction for the next scholastic year.

Bulletin 47 of the University of Illinois is on "Magnetic Properties of Hensler Alloys"; bulletin 46 is on "The Spontaneous Combustion of Coal with Special Reference to Bituminous Coals of the Illinois Type";

and bulletin 48 is on "The Resistance to Flow Through Locomotive Water Columns."

The University of Illinois will receive from the Legislature, recently adjourned, for its support for the two years following July 1, 1911, the sum of $3,500,000. Something more than half a million dollars of this amount is for buildings. The College of Engineering, the success of which interests many of our readers, received specific appropriations for maintenance amounting to $192,000 and for a building $200,000 In addition to this the department of Mining Engineering received an appropriation for maintenance amounting to $35,000 and for equipment $25,000. The Legislature in providing for the future support of the university has authorized a one mill tax upon the assessed value of the state.

Technical Meetings.

The sixth annual convention of the International Association for the Prevention of Smoke is in session in Newark, N. J., as this number of MUNICIPAL ENGINEERING is mailed. The gas producer, large power stations, and smoke prevention devices are discussed by experts and smoke prevention ordinances also receive full attention. Among the principal speakers are Prof. R. H. Fernald, U. S. Bureau of Mines; Dr. E. J. Lederle, commissioner of health, New York City, and the chief engineers of the Public Service Corporation of New Jersey. R. C. Harris, smoke inspector of Toronto, Ont., is secretary and treasurer.

The American Society for Testing Materials held its meeting at Atlantic City, N. J., June 27 to July 1. Reports and papers of special interest to our readers are those on specifications and tests for clay and cement sewer pipes, Rudolph Hering, chairman of committee; specifications for building and paving brick, D. E. Douty, chairman of committee; practical tests of sand and gravel proposed for use in concrete by Russell S. Greenman; the absrption of concrete by Abel O. Anderson; the expansion and contraction of concrete on hardening by Albert T. Goldbeck; disintegration of concrete by Alfred H. White; the effect of high pressure steam on the crushing strength of concrete by Rudolph J. Wig; standard tests for road materials, Logan W. Page, chairman of committee; a new consistometer for use in testing materials, by W. W. Crosby; standard methods of testing sewer pipe and drain tile, by A. Marston.

The International Municipal Congress and exposition, to be held in Chicago, September 18 to 30, is developing into a large organization. Japan recently took the preliminary steps for an exhibition of the condition of its municipalities.

New York's second annual architectural and engineering show will be held the first of March, 1912. A special feature of the show hereafter will be architectural drawings, especially those of students and also model construction and arrangements will be made to annually present the new inventions of the year in a special department. Interior decoration and landscape architecture will also be elaborately developed and the conference of architectural and engineering interests will be developed to be held at the same time but independent of the exhibition. A. D. V. Storey is general manager, 110 West Thirty-fourth street, New York.

The annual meeting of the New York Electrical Society was held June 15 at Brighton Beach and an interesting feature was as explanation with examples of the electrical developments at Coney Island and the methods of operating the apparatus.

Calendar of Technical Meetings.

American Society for Testing Materials.—Annual meeting at Atlantic City, N. J., June 27 to July 1. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

Ohio Electric Light Association.—Annual convention at Cedar Point, Ohio, July 25-28. D. L. Gaskill, secretary, Greenville, Ohio.

International Association of Municipal Electricians.—Annual convention, St. Paul, Minn., September 12-15. Clarence R. George, secretary, Houston, Texas.

International Municipal Congress and Exposition.—Coliseum, Chicago, Ill., September 18-30. Curt M. Treat, secretary, Great Northern Building, Chicago, Ill.

Fourth International Good Roads Congress.—Chicago, Ill., September 18 to October 1. J. A. Rountree, secretary, Birmingham, Ala.

International Association of Fire Engineers.—Annual convention, The Auditorium, Milwaukee, Wis., September 19-22. James McFall, secretary, Roanoke, Va.

American Society of Municipal Improvements.—Grand Rapids, Mich., September 26-29. A. Prescott Folwell, secretary, 239 W. Thirty-ninth street, New York City.

League of American Municipalities.—Annual convention, Atlanta, Ga., October 4-6. John MacVicar, secretary, Des Moines, Iowa.

National Municipal League.—Annual meeting. Richmond, Va., November 13-17. Clinton Rogers Woodruff, secretary, North American Building, Philadelphia, Pa.

John H. Gregory.

Mr. John H. Gregory, who is the junior partner in the new firm of Hering & Gregory, has had practical experience for 18 years. He was engaged first in Massachusetts on design and construction work with the Metropolitan Sewerage Commission, and afterwards on design with the Metropolitan Water Works.

He was then Assistant Engineer and later Resident Engineer with Allen Hazen on the Albany filteration plant. Following this he was in charge of designs for the water filtration plants in Philadelphia. Then

he was engaged on the design and construction for the new water supply for Jersey City, N. J.

In 1903 he was principal Assistant Engineer in the filtration department of the Commission on Additional Water Supply for New York City. Following this he was engaged by the City of Columbus, and as Engineer in Charge, designed and built the water purification and softening works and the sewage purification works. He also made for the same city an investigation of the garbage disposal problem, which resulted in the construction of the present work.

Following the completion of these works Mr. Gregory spent nearly five months in Europe examining many of the important works for water supply, sewerage and refuse disposal and other sanitary improvements.

After his return Mr. Gregory was Resident Engineer in Newark, N. J., for the Passaic Valley Sewerage Project, and recently has been Engineer with the Metropolitan Sewerage Commission of New York City.

Mr. Gregory has also been associated with the firm of Hering & Fuller at various times since 1902 in connection with numerous water filtration projects, among which were the Hackensack Water Company, the New Haven Water Company, and the investigations for the report on the new Montreal Water supply.

Personal Notes.

Samuel D. Foster, of Pittsburg, Pa., who has been in charge of the roads of Allegheny county, has been appointed chief engineer of the State Highway Department of Pennsylvania under E. M. Bigelow, M. Am. Soc. C. E., commissioner, at a salary of $7,000 per annum.

Fred T. Barcroft, M. Am. Soc. C. E., of Detroit, Mich., has been appointed a member of the City Plan and Improvement Commission of Detroit.

Oscar Brown has been elected mayor of Lulu, Ga.

Bryan Callaghan has been elected mayor of San Antonio, Tex.

H. E. Christenbery has been elected mayor of Knoxville, Tenn.

Herman Gamper, superintendent of the Columbus, O., city electric light plant, will go to Erie, Pa., in July as superintendent for the Erie Electric Light Co.

David Grotta is the chairman of the new City Plan Commission of Newark, N. J., appointed by Mayor Hansling.

Harrison W. Howell has been elected mayor of Wilmington, Del.

Emory C. Crum has been appointed city engineer at Frederick, Md.

A. T. Dickey is city engineer and W. B. McGarvey is assistant city engineer at Galveston, Tex.

R. K. Compton, for some years assistant city engineer in Baltimore, Md., has been elected chairman of the city paving commission recently appointed by the mayor.

H. P. Mobberly and W. A. Burton have joined in a consulting practice to give attention to municipal engineering, drainage, hydro-electric and railroad work, opening offices at 422 Woodruff Building, Springfield, Mo.

Robert A. Kuss, deputy, is temporarily in charge of the Chicago smoke inspection on account of the resignation of Paul P. Bird.

John C. Watts has been appointed assistant city engineer at Troy, N. Y.

Edwin Hancock, the new city engineer of Lagrange, Ill., is a member of the firm of Ewing and Stone Company, consulting engineers, Chicago.

Charles Seville was assistant engineer to the Massachusetts State Board of Health from 1906 until he went abroad with Rudolph Hering in 1910 to inspect engineering works in France, Switzerland, Germany and England. Among the works examined were the more important ones for water purification, sewage purification and refuse destruction. While in Essen, Germany, he was engaged by Dr. K. Imhoff as an assistant to him for one year, during which time he has been engaged on the design and construction of works for sewerage, sewage disposal and stream corrections. At the termination of his engagement this summer he will be associated with the firm of Rudolph Hering and John H. Gregory in New York.

E. A. James, engineer, of North Toronto, Ont., has been appointed engineer of road improvements in York county.

S. L. Etnyre, city engineer of Council Bluffs, Iowa, for 14 years, has resigned to become superintendent of the water works of the city.

K. D. McLean, formerly sewer construction engineer in the city engineer's office of San Francisco, Cal., has been appointed superintendent of construction for the Board of Harbor commissioners.

John R. Freeman, of New York, will make an appraisement of the Spring Valley Water Company as a preliminary to the purchase of the property by the city of San Francisco, Cal.

James H. Fuertes spent May and June on a report on the sewerage of Para, Brazil, and will return to the United States about July 15.

Joseph W. Hamilton has resigned from the U. S. Reclamation Service to become city engineer of Pasco, Wash.

E. F. Harper is city engineer of East St. Louis, Ill., F. W. Rodenberg is assistant in charge of utlet sewer, and James F. Parr, assistant in charge of streets.

Alfred S. Hirzell is city engineer of Wilmington, Del.

A. M. Hunt, who has had much experience in hydro-electric work and helped convert Los Angeles city railways from cable to

electric power, has been appointed consulting engineer for the Geary Street, San Francisco, municipal railway.

Arthur B. Morrill, of the sewage experiment station of the Chicago Sanitary District, has been appointed professor of hydraulic and sanitary engineering in the University of Tien-Tsin, China.

Dr. Thomas Darlington, formerly health officer of New York City, will work out a general plan for the sanitation of the towns about the manufacturing plants owned by the members of the American Iron and Steel Institute.

J. B. Lippincott, assistant chief engineer of the Los Angeles aqueduct, is one of a committee of four engineers to devise a plan for controlling the lower Colorado river.

Willis S. Jones is city engineer of Pomona, Cal.

G. A. Mann continues as city engineer of Reno, Nev.

C. M. Nixon has been elected mayor of Amite, La.

H. B. Moores is mayor of Henning, Tenn.

Frank K. Mott has been re-elected mayor of Oakland, Cal.

E. A. Peyton is superintendent of water and sewers in Chickasha, Okla.

A. G. Rushlight has been elected mayor of Portland, Ore.

Charles Van Amburgh, Binghamton, N. Y., has been appointed county superintendent of highways.

DeWitt Webb has been elected mayor of St. Augustine, Fla.

R. E. McDonald, C. E., of Kansas City, Mo., is aiding in a valuation of the water plant at Green Bay, Wis., which the city proposes to purchase.

Frank Rumbold is commissioner of public works at Tonawanda, N. Y.

John W. Stevens is president of the board of water supply at Mt. Vernon, N. Y.

Daniel J. Hauer has opened an office in the Park Row building New York City, for practice as a consulting engineer and construction economist.

Messrs. Rudolph Hering and George W. Fuller, hydraulic engineers and sanitary experts of New York City, announce the termination of their ten-year partnership agreement under the firm name of Hering & Fuller, excepting as to certain existing engagements which they as a firm will complete. For all new engagements they will hereafter conduct independent offices at their present address, 170 Broadway, New York City.

Mr. Arthur M. Blanchard, M. Am. Soc. C. E., consulting highway engineer, has resigned from the position of associate professor of civil engineering at Brown Unicersity to accept the appointment of professor of highway engineering at Columbia University. Mr. Blanchard will have charge of the graduate courses in highway engineering which will be established at Columbia University next year.

Messrs. Rudolph Hering and John H. Gregory announce that they have entered into partnership as consulting engineers and sanitary experts with offices at 170 Broadway, New York City, and will conduct an engineering business covering investigations, reports, designs and superintendence, relating to projects concerning water supplies, water purification, sewerage, sewage purification, and refuse disposal.

H. von Schon, consulting engineer, Detroit, Mich., has been engaged by the Gila River Development Co. to make plans for utilizing a 500-foot fall in the vicinity of Silver City, N. M.

H. L. Gillespie, president of the Union Clay Products Co., New York, sailed on June 17th, for an extended trip through Europe.

Mr. George W. Fuller, hydraulic engineer and sanitary expert, announces that he has associated with him as partners Messrs. James W. Armstrong, James C. Harding and James R. McClintock, all of whom were formerly on the staff of Hering & Fuller. Mr. Armstrong had more than a dozen years' experience in general engineering practice, especially in railroad and structural iron work and then for ten years he was on the staff of Mr. George C. Earl, general superintendent of sewerage and water of New Orleans, first in charge of the design of nine sewage pumping stations and later in the immediate charge of the design and construction of the New Orleans water purification plants and appurtenances. Recently he has had immediate charge for Hering & Fuller of the design of water purification plants for Grand Rapids, Mich., Minneapolis, Minn., and Montreal, P. Q. Mr. Harding spent some five years as assistant to Mr. Ernest Bowdich and then for ten years was assistant city engineer of Pittsfield, Mass., in charge of the construction and operation of the sewerage system, sewage pumping station and sewage disposal works. Since 1907 he has been with Hering & Fuller, principally on sewerage work, and has had immediate charge of the design of sewerage and sewage purification works for Atlanta, Ga., Batavia, N. Y., Rome, N. Y., New Brunswick, N. J., Vincennes, Ind., etc., and also investigations of typhoid fever epidemics at Coopertown, N. Y., Wilkes-Barre, Pa., Des Moines, Ia., etc. Mr. McClintock has been for the past five years with Hering & Fuller, partly on designing and partly on outside work, particularly with reference to water works appraisements and the construction of water filters. He was resident engineer on the water filtration plant of Burlington, Vt., and at present is in charge of extensive improvements to the water works and sewerage systems of Clarksburg, W. Va. The offices of Mr. Fuller and his associates will be at 170 Broadway, New York City.

MACHINERY AND TRADE

The Manual of Statistics.

The 1911 edition of The Manual of Statistics has just appeared, being the thirty-third annual issue of that standard publication. It fully covers the many important changes which have taken place during the past year in corporate affairs in the United States and Canada, and gives details of the numerous new stock and bond issues of railroad and industrial organizations. The 1092 pages of this carefully compiled reference volume present a great fund of information for the use of investors and speculators. At the same time it embodies ample information regarding government securities, mining stocks and the grain and cotton statistics. Its utility is increased by an arrangement tendering references to the different sections easy and satisfactory.

The edition also devotes much attention to the new railroad, industrial and mining companies, and gives the many changes in dividend payments which have occurred down to the date of its issue. It is published by The Manual of Statistics Company, 20 Vesey Street, New York. Price, $5.

Expert Development of Trinidad Maltha.

To take charge of a new department which will handle its recently developed Trinidad liquid asphalt products, the Barber Asphalt Paving Co. has engaged the services of Dr. Albert Sommer, whose accomplishments in the field of asphalt chemistry and development have given him an international reputation.

Dr. Sommer came to the United States in 1905 from the Technical University of Dresden, where he was assistant and instructor under Prof. Walter Hempel, who is regarded as the foremost authority on gas analysis, industrial chemistry, and the technology of fuels. Studies in chemistry, physics, electrical, civil and mechanical engineering and geology were followed by graduation at Dresden as diplom ingenieur in 1902 and the degree of doctor ingenieur in 1903, and then by the association with Prof. Hempel.

Until recently Dr. Sommer was in charge of the scientific and development work of the Texas Company, especially directed toward the manufacture and improvement of products from Texas and mid-continent petroleum and their application as solvents and lubricants, and also of bituminous and asphaltic products for paving and road building. In 1910 he was appointed lecturer on petroleum and its products at the School of Marine Engineering of the United States Naval Academy at Annapolis, which position he still holds.

Among the scientific bodies of which Dr. Sommer is a member are American Society for Testing Materials, American Chemical Society, Society of Chemical Industry, American Gas Institute, Verein Deutscher Chemiker, American Society of Civil Engineers, American Society of Naval Engineers, the Engineers' Club and the Chemists' Club of New York.

Dr. Sommer is already actively engaged in the development work undertaken immediately upon the discovery of the Trinidad maltha in the neighborhood of the asphalt lake. He describes this discovery as the "mother substance" of Trinidad asphalt, and one that, having no exact counterpart among the malthas heretofore known to the asphalt industry, is destined to play an important part in the future progress of street paving and road building.

Street Paving in Phoenix, Arizona.

A special committee composed of Joseph H. Kibbey, Dwight B. Heard and Charles Stauffer, recently held a meeting with the various contractors of Phoenix, at which the conditions of bidding were clearly explained and a typewritten statement accompanied by form of bid, furnished each of the contractors. After the opening of the bids the committee went into an executive session. The bids were very carefully tabulated and after their consideration the committee decided that, owing to climatic conditions and the good appearance, durability, etc., that bitulithic should be used.

Orange avenue, Pasadena, is now being paved with the Warren Brothers' mixture and the following cities, where climatic conditions are somewhat to those of Phoenix are using this pavement: Dallas, Tex.; Shreveport, La.; El Paso, Tex.; Atlanta, Ga.; Mobile, Ala.; Birmingham, Ala.; Fort Worth, Tex.; Boise, Idaho., and Newton, Kas.

At a meeting of the Phoenix city council May 12, 1911, the contract was awarded to bitulithic in accordance with the recommendations of the citizens' paving committee.

The Cost of Engineering.

In his testimony before the Public Service Commission of New York on the valuation of the Metropolitan Street Railway, Prof. D. C. Jackson, of D. C. & Wm. B. Jackson, Chicago and Boston, cited as examples the figures on certain work in Boston.

The cost of engineering of the Boston Transit Commission for the East Boston tunnel, taking the cost down to and including contractors' profit as the denominator, was 7 per cent. The general expenses,

which were the administrative expenses of the commission and the commissioners' salaries, amounted to 6.1 per cent. and the interest paid during construction on the bonds and indebtedness was 9.4 per cent. The cost in this case was $3,200,000. In the case of the Tremont street subway, Boston, the cost of which was $4,400,000, the engineering percentage was larger. In the case of the Washington street tunnel, Boston, which cost $8,000,000, the engineer's office expenses were 6.1 per cent, the commissioners' administrative and salary and like expenses were 3.2 per cent, and the interest during construction was 9.7 per cent.

The Hotchkiss System of Steel Forms.

One of the great items of cost in concrete construction of all kinds is the cost of forms. The ordinary wood forms, though frequently reused, are damaged to such an extent that their renewal is a constant item of expense. This is particularly true of the forms used in sidewalk and curb and gutter work.

There has been recently manufactured and sold a system of forms for this latter class of work, which is particularly efficient and economical. These forms, made of steel throughout, are manufactured by the Hotchkiss Lock Metal Form Co., Binghamton, N. Y.

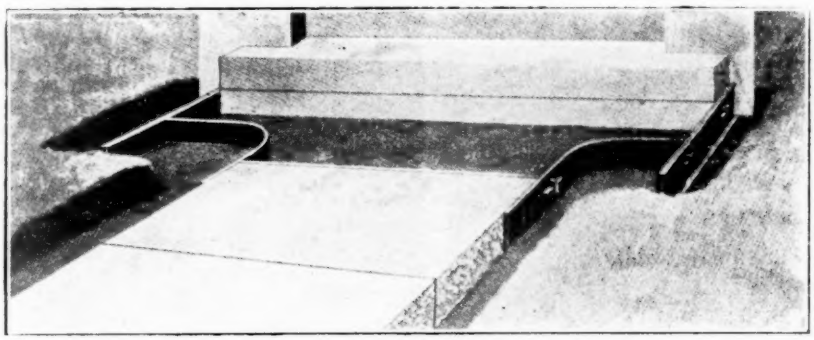
The Hotchkiss steel curb and gutter forms consist of steel templates which conform in shape to the finished curb and gutter. To serve as molds for the back of the curb and the front of the gutter are provided steel channels, which are slotted at regular intervals. On the front and back of the templates are tongues which pass through these slots and are locked there by lugs on the outside. When set up in this manner they form a rigid and substantial form that will stand alone and which does not need any stakes or braces. The accompanying photograph shows the forms in use.

The standard curb form which this company manufactures provides for a twelve-inch curb, 6 inches thick, and with a face 6½ inches high. The gutter is 18 inches wide and dips 1½ inches towards the curb. They are made interchangeable; that is, the same back and front rails are used for either straight curb or combined curb and gutter. Other sizes than those mentioned may be obtained.

The steel sidewalk forms manufactured by this company consist of straight, rigid side rails, flexible side rails, cross pieces or division plates of various lengths, and wedge-shaped keys or lugs for fastening these parts together.

The rigid side rails are 10 feet long, 4 inches high, and have slots at one-foot intervals to receive the division plates. They have a flange at top and bottom to keep them rigid, and in use are joined end to end by a tongue and socket. Rigid side rails are also made 4 feet and 6 feet in length, slotted at three-inch and six-inch intervals.

The flexible side rails are made 4, 6, 8 and 10 feet long, 4 inches high and have no flanges. They are made of spring steel and may be bent to an ydesired curve; for curves of long radius flexibles are made of heavier steel. The method of use is shown in the photograph. They manufacture to order any desired length. The cross pieces or division plates are simple; all that is required of them is uniformity.



HOTCHKISS STEEL SIDEWALK FORMS

The points of superiority possessed by the steel forms over the old types of wooden forms are:

The saving in cost of form material.

The saving in labor, due to the ease of setting and removing them.

They are more accurate to both line and grade.

They are light and easy to handle and practically indestructible.

Some Notes on Creosoting.

The Wyckoff Pipe and Creosoting Company, 50 Church street, New York, have published a very interesting booklet on creosot-

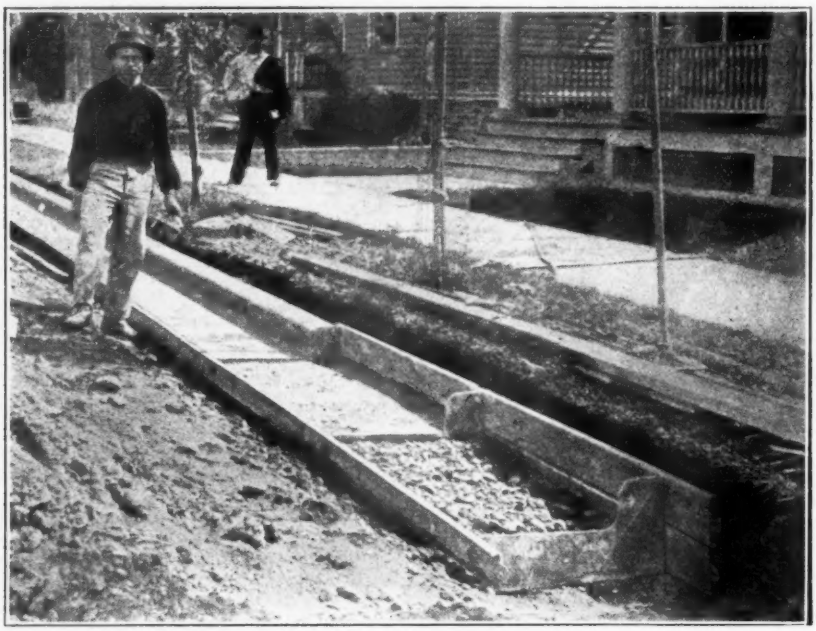
ing. A short history of the subject is given, which is as follows:

"The preservation of wood is an old art and has been practiced since the beginning of the eighteenth century. In 1705 Homberg soaked in a weak aqua solution of corrosive sublimate. In 1730 Job Baster treated wood with an aqua of corrosive sublimate and arsenic for shipbuilding purposes. In 1740 Reed used wood vinegar. Fagot used alum, iron vitriol and steam. This treatment of Fagot's in 1740 is the first noticed using steam for the preservation of wood. In 1756 Hale treated wood with a solution of tar oil and wood vinegar. About this time the process generally used for preserving wood was to dip it in boiling hot wood tar. In 1756 Jackson used a mixed solution of sea salt, lime, sulphate of zinc, alum, epsom salt, ashes and sea water. From 1767 to 1812 the solutions just mentioned were used in a variety of ways. In 1812 coal tar was first used by Cook for the preservation of ships and ship timber. In 1823 Oxford used for the first time oils distilled from tar, applying them to the wood as paint. In 1835 Moll was the first to use the vapors of wood tar and creosote, the wood being enclosed in tight chambers. In 1838 dead oil of coal tar was first introduced as a preservative of timber by Mr. Bethell in England. In 1848 May also treated wood according to the present method with heavy tar oils or creosote. The wood was first subjected to superheated steam and then to creosote vapors in a cylinder under pressure."

The Wyckoff Company manufactures a type of wood pipe which is extensively used for cable conduits, etc. This pipe is manufactured in eight-foot units of uniform 4½-inch by 4½-inch section and a 3-inch base. The square section admits of the units being used together to carry a cable system having a number of lines. The joints are held together by "mortise-and-tenon" joints.

The conduits, after their preparation, are subjected to the following process: First, they are subjected to live steam under a pressure of between thirty and forty-five pounds to the square inch for from three to seven hours. Second, they are immediately subjected to a vacuum of twenty to twenty-four inches of mercury until all the sap and moisture possible is extracted

Following this treatment, while the wood is still warm from the effects of the steaming treatment and while a 75 to 90 per cent. vacuum exists in the pores of the timber, the oil is admitted into the treating cylinder and is sucked into the pores of the wood by the existing vacuum to the extent of a number of pounds per cubic foot. Hydraulic pressure is then applied and continued until the wood has been impregnated with the required amount. The quantity usually required is twelve pounds of oil per cubic foot, which experience has shown is sufficient to prevent decay in ordinary situations. For some classes of timber, such as oaks and long leaf yellow pine containing quite a percentage of heart wood, a less quantity may be safely employed.



HOTCHKISS STEEL CURB AND GUTTER FORMS.

This thorough treatment has been shown to give a decay-resisting wood, which has been shown in a number of instances to have been in a perfect state of preservation after twenty or more years of service.

The booklet (Catalogue "M") contains a great deal of valuable and interesting material. It will be sent upon request to engineers and contractors interested.

Roads That Pay.

Good roads are expensive, but it costs more money to do without them than to build them.—James J. Hill.

The above quotation, which appears on the fly-leaf of an interesting booklet by the American Asphaltum and Rubber Co., 600-614 Harvester building, Chicago, is aptly descriptive of the facts which the booklet contains. That permanent roads, roads that can endure the wear of the modern automobile, are shown to be more economical than the temporary makeshift road. The results to be attained through the use of "Pioneer" road asphalt in the construction of dustless, waterproof roads are shown in a series of photographs of highways in various parts of the country.

One excellent example noted is the "Peachtree Road" near Atlanta, Ga., which has been called "the Appian Way of the South." This road was constructed in 1909 under the supervision of the U. S. Agricultural Department. Among the other examples of "Pioneer" construction noted are the following: Sheridan road, Chicago; State highway, Wilmington, Mass.; Lyndale ave., Minneapolis, Minn., and Nelson ave., Columbus, Ohio.

The last named road was constructed under the supervision of the Ohio State Highway Department as an experimental road. It was pronounced by James C. Wordens, State Highway Commissioner, to be in excellent condition after a year of service.

The back portion of the book contains points of value concerning the use of "Pioneer" road asphalt and includes a valuable set of specifications for asphalt macadam roadways.

Modern Municipal Illumination.

The Flour City Ornamental Iron Works, Minneapolis, Minn., have issued a catalogue "de luxe" under the above title. This catalogue is attractive is attractive in its execution and contains much information of value to those interested in the live question of ornamental street lighting.

It has become an established fact that the modern system of street illumination is not only an indication of progress and good business conditions, but is actually a factor in producing them. The Flour City Ornamental Iron Works was one of the pioneers in the field of advanced street lighting and has done much to educate municipalities along this line.

The catalogue mentioned contains photographs of a number of types of lighting standards, some of which are familiar through their use in a number of cities. The most familiar one of these, the "Corinthian," was the first standard manufactured by the company and one which has been adopted by a number of the larger cities, among which are Atlanta, Ga.; Duluth, Minn.; Minneapolis, Minn,; Jacksonville, Fla.; Fort Dodge, Ia.; Milwaukee, Wis.; Oklahoma City, Okla., and Winnipeg, Can. This standard, as its name implies, is an adoption of the Corinthian column, with cross arms supporting four ball globes, either erect or pendant, and a center ball supported on a sort of vase. The whole is consistent and offers a pleasing, substantial and dignified appearance.

The other types of street lighting standards shown are the "Capitol" and the "Egyptian," both being manufactured with either the upright or pendant ball globes. Other ornamental standards suitable for use on city halls and other public buildings are shown.

A recent innovation in connection with the ornamental lighting is the substitution of red, blue or other colored center globes near police call boxes. By means of these, flash signals from headquarters may be flashed to any local district. This assures that patrolmen may be reached when needed, for the lights may be so installed as to be visible from all points on any beat.

The Mueller Sewer Rod.

The Mueller sewer rod is made for convenience in opening clogged sewers. It is a continuous strip of special spring steel, tempered so as to allow it to conform to the irregularities of the sewer. It has sufficient strength and spring to keep it from buckling or breaking. When it is withdrawn it becomes a straight steel rod, that can be coiled as it is taken from the sewer.

The working end is provided with a sharp spear point, which will easily penetrate any obstruction in the passage. Just back of the point there are a number of barbs bent outward, but projecting backward from the spear point so they will not interfere with the genetrating force of the rod. By working the rod back and forth it is possible to tear loose the most obstinate stoppage.

By reason of its flexibility it may be made to conform easily to the irregularities of the sewer. It is not clumsy and will work well in a limited space. It will easily penetrate a stoppage.

The rod is manufactured by the H. Mueller Co., West Cerro Gordo street, Decatur, Ill.

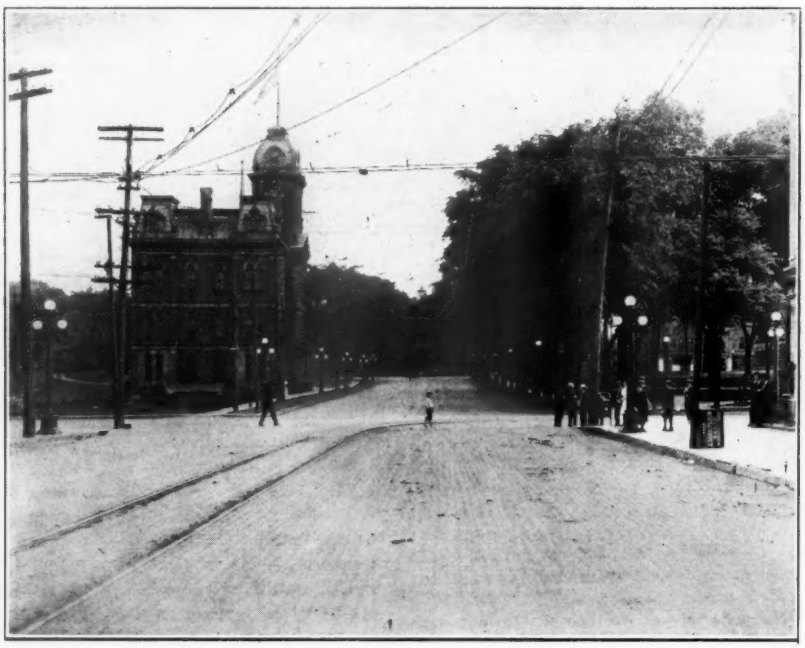
Street Lighting as a Feature in Municipal Improvement.

Civic improvement is of paramount importance to the municipality that would keep abreast of the times, and none is more conspicuously necessary in the majority of American cities than that of better street lighting conditions. The sentiment in favor of brighter streets, however, is rapidly gaining ground, and the last few years have witnessed the installation of modern street lighting systems in many of our cities.

Among the cities to realize the importance of proper street lighting, special interest attaches itself to Warren, Ohio, a city of approximately 12,000 people. The street lighting installation which has recently been completed there is one that embodies the most modern ideas on street lighting, since all parts of the city are now lighted by the most up-to-date street illuminant—the Mazda incandescent lamp.

The most spectacular part of the whole system is that in the central business district, where there are eighty-six ornamental standards. Twenty-two of these are placed around the spacious public park, and support a single lamp in an upright position. Directly in front of the court house and near the center of the park are two 5-light standards. The remaining sixty-two units are 3-light standards. The pendant lamps are of 40 c. p. and are enclosed in 12-inch Alba globes, with the exception of the park standards which have 60 c. p. lamps, all the standards have 80 c. p. upright lamps enclosed in 14-inch Alba globes. The wiring of the lamps is such that the pendant lamps can be turned off at midnight, leaving the upright lamps to burn until daybreak.

Although the downtown lighting has received much attention and compares most favorably with the same style of lighting seen in other American cities, the residential streets have not been neglected. The present residential street lighting had its beginning in two trial installations that were installed about two years ago. Such unanimous approval was expressed in regard to the results obtained from these two systems that it was determined to have all the streets in the city equipped with Mazda incandescent lamps. The residential lighting system now installed includes 620 Mazda incandescent lamps suspended from goose-neck brackets, the latter being attached to wooden poles. The units are spaced as uniformly as possible, along one side of each street, and the distance between units on any street depends on the amount of traffic. A much more uniform illumination is produced than that existing with the old system of open arc lamps. All who have investigated the incandescent system are highly pleased and have not been slow to express their appreciation.



MAZDA INSTALLATION IN WARREN, OHIO

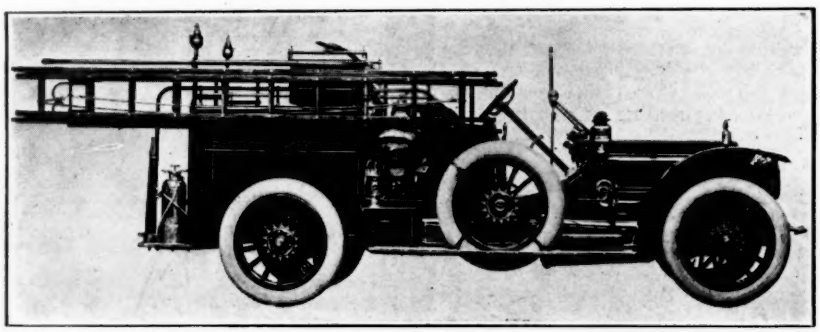
Municipal Service Cars.

The use of motor propelled fire apparatus, patrol wagons and ambulances, has passed the experimental stage and has come to the point where the horse-drawn equipment particularly in the latter two instances, is unusual. The Thomas B. Jeffrey Company, Kenosha, Wis., have a very complete line of municipal service cars, which are the development of a careful consideration of the needs of such service.

The chassis used for these cars are especially built for the purpose. The frames and axles are heavily braced and reinforced by bridge trusses, all forgings being designed with a large margin of safety.

The accompanying photographs show the "Rambler" combination chemical and hose truck. The weight of this car in service is 5,000 pounds. It carries the following equipment: Two 9-in. gas headlights with Prest-O-lite gas tank and instantaneous lighter on the dash, combination oil and electric side and tail lights with separate storage battery (optional). The body has a carrying capacity for 850 to 1,000 feet of 2½-inch hose, which is not included in equipment.

The standard Rambler touring car motor is used and has in the past proven its reliability. It is the four-cylinder water cooled type, the cylinders being cast separately with the heads, valve pockets and water jackets integral. The bore is 5 inches and the stroke 5½ inches, each motor developing 45 horse power. The carbureter is water jacketed and provided with a starting device, which makes starting the motor easy and sure. The oiling is through a mechanical oiler placed on the crank case feeding directly to each cylinder and through splash from an oil level maintained in the crank case itself. Two separate and independent sets of ignition are supplied, although only one set of spark plugs is used. For starting and for running in case something should happen to the magneto, a six-volt, eighty-hour storage battery is provided, which through the coil on the dash, the high tension switch and the Rambler timer, provides one set of ignition. The other set is a high tension Bosch magneto, which delivers its currents to the spark plugs through the Rambler high tension switch, and without using the coil. Either ignition set can be removed, and the car operated upon the other.



1911 RAMBLER COMBINATION CHEMICAL AND HOSE TRUCK

and individual switches on the dash, Rambler folding gas front, Rambler spare wheel complete with tire, brackets and tools, speedometer with clock and electric light, brass bumper, full set of tools, tire repair kit, pump, jack, etc. And the following fire-fighting equipment: One 40-gallon chemical tank with extra acid receptacle and holder, 200 feet best grade ¾-inch four-play chemical hose in 50-foot lengths with couplings and nozzle, perforated steel hose basket with brass rollers, or hose reel (optional), two 3-gallon underwriters' approved hand extinguishers with cups, one 12-foot Pirsch patent trussed roof ladder with folding hooks, one 22-foot Pirsch patent trussed extension ladder, two 8-foot combination plaster hooks and pike poles, one combination door opener and hose shut-off, two pick-back fire department axes with brackets, two brass fire department lanterns with holders, suitable brackets for ladders, pike poles, etc., tool box under rear step, two-nozzle plugs on rear step, two ornamental torches on ladder brackets, rotary gong, or locomotive bell

The tires provided for Rambler service cars are so large as to afford a wide margin of safety, consequently reducing tire trouble to a minimum, but in case of puncture the spare wheel with inflated tire can be substituted for the wheel with damaged tire in three minutes or less. The spare wheel is interchangeable with all four wheels, and the repair when made is permanent. When the car returns to its station, the damaged tire is then repaired, inflated, and thereafter carried on the running board as a spare wheel.

The Rambler motor fire trucks have been shown to be economical under actual service conditions. In a period of five months a Rambler motor fire truck at Kenosha, Wis., answered 39 alarms and made about as many

more inspection runs. The total cost for gasoline, oil and water was $1.37 per month, while formerly it cost $1.25 per day for feeding, shoeing, bedding and doctoring the pair of horses for the fire truck.

Among the cities which are using the Rambler municipal service cars are the following: Whittier, Cal.; Long Beach, Cal.; 21Pomona, Cal.; Decatur, Ill.; Minneapolis, Minn.; Sacramento, Cal.; Harrisburg, Pa.; Dallas, Tex.; Logansport, Ind.; Chicago, Ill.; and Kenosha, Wis.

Fisher Hydraulic Ramming Concrete Machinery.

There has been stated an objection to the ordinary concrete block, on the grounsd that it was not impervious to water, and that it absorbed moisture so as to render it objectionable for building. This objection has been eliminated by the use of Fisher Hydraulic Ramming Concrete Machine, manufactured by a company of that name at Mount Gilead, Ohio.

The principal upon which the machine operates is in the use of a very wet mix driven together by hydraulic ramming until the air is entirely displaced. By displacing the air the aggregate is brought so closely together that adhesion is produced by suction and the mass rendered waterproof.

The wet mix supplies the cement with the necessary moisture to give full crystallization during the initial set. A much less amount of cement is required in this process to develop strength and density.

The machine will make any style hollow block, angle block, veneering, etc. Capacity No. A. machine operated by two men is guaranteed to be over 600 per day. Each block equals 20 brick in wall construction. Architects approve of the process and admit that it produces the most effective cement possible.

The blocks have been shown by test to be practically impervious. Under some tests run by the Johns Hopkins University the following results were obtained:

Sample 1, faced block, weight when dry, 3,005 grams.

Weight after 48 hours immersion, 3,083 grams.

Gain, 78 grams, or, 2.6 percent.

Weight after 48 hours immersion, 3,096 grams.

Gain, 91 grams, or, 3 per cent.

Sample 2, faced block, weight when dry, 3,126 grams.

Weight after 4 hours immersion, 3,246 grams.

Gain, 120 grams, or, 3.6 per cent.

Weight after 48 hours immersion, 3,258 grams.

Gain, 132 grams, or 4.2 per cent.

Sample 3, rough block, weight when dry, 3,057 grams.

RAMBLER CHEMICAL TRUCK IN KENOSHA

Weight after 4 hours immersion, 3,090 grams.

Gain, 33 grams, or 1.1 per cent.

Weight after 48 hours immersion, 3,111 grams.

Gain, 54 grams, or 1.8 per cent.

A fire in the plant of the Patapsco Oil and Grease Co., Baltimore, Md., constructed of Fisher blocks, has proven conclusively that they possess great fire-resisting qualities. A fire broke out about midnight in the second story where there were thousands of barrels of oil and other combustibles stored. So threatening was the fire that the second and third fire alarms were sent in and brought out fourteen fire engines which were also assisted by the fire boat "Cataract" throwing a stream from the Chesapeake bay or basin, a distance of about 100 feet, into and against the burning building. This fire was fought with the same precaution, as a wall constructed of brick, expecting that it

would crumble and fall, three of the walls were self-sustaining and exposed. As the roof fell the flames extended high into the air, when this vent was given to the fire, the inside became a roaring furnace of burning oil and oil saturated wood floors and joists.

The blocks were subjected to this intense heat, and while heated quantities of water poured on them, through the openings and from the roofs of the adjoining buildings many streams of water poured in the top of the burning building. The walls remained unaffected, resisting both destructive elements.

The Fisher machine may be operated very economically, requiring only two men to operate. This fact, together with the density and strength of the blocks made, are strong points in its favor.

Trade Publications.

The Vulcan Soot Cleaner Co., Pittsburg, Pa., have a valuable booklet describing the application of their device in economical steam production. The value of the soot cleaner in the saving of labor, economy of fuel and as a smoke reducer is noted.

The Coltrin Concrete Mixer, manufactured by the Knickerbocker Co., Jackson, Mich., is described in a thirty-page illustrated booklet by that company. The application of different sources of power, and detailed drawings and descriptions of parts are given, together with views of the machines in operation.

The Buffalo Pitts Company, Buffalo, N. Y., have an exceptional catalogue descriptive of their special hauling machinery. The contractor's special engine and a number of special "road freight cars," together with their use in road work, are shown. The road cars with their very broad tires, and side, and bottom damp features are unique.

The Warren Brothers Co., Boston, Mass., have published a book entitled "Municipal Powers, the Right of Cities to Purchase Patented Articles Sustained by the Highest Courts." It contains the text of decisions in the various states regarding the meaning of charter provisions requiring competitive bidding.

The June Bulletin of the Lehigh Portland Cement Co., Peoples Gas Building, Chicago. It is a very attractive issue, containing among other photographs, those of the Black Warrior River Improvement in Alabama. A description of the locks and dams is given.

The American Asphaltum and Rubber Company, 600-614 Harvester Building, Chicago, have a booklet describing asphalt macadam roadways and the success of the pentration method of applying binder.

The Water Works Equipment Co., 50 Church street, New York, have a catalog describing their tapping machines, hydrants, service boxes, thawing apparatus and other water works specialties.

The Lead Lined Iron Pipe Co., Wakefield, Mass., have a leaflet descriptive of their pipes and specials, which are unique in that they are lined with lead or tin.

The Water Works Equipment Co., 50 Church street, New York, have a small catalog showing their line of contractors pumps which are manufactured by A. A. Parker, Waterford, N. Y. Full details regarding parts, operation, dimensions, etc., are given.

The Allis-Chalmers Co., Milwaukee, Wis., have three catalogs which meet their standard of excellence in detailed clearness of description. The first of these, Bulletin No. 1411 on "Modern Rock Crushing Plants," contains photographs and descriptions of all machines entering into such plants, together with drawings showing layouts, etc. The second Bulletin No. 1448, contains a description of their Type "K" Breakers, together with tables of sizes, capacities, etc. This has been revised to bring it up to their present practice and contains much interesting information. The third, Bulletin No. 1523, gives a general description and photographs of stationary air compressors for industrial purposes.

The Mueller reducing and regulating valves are described in Catalog No. 2 issued by the H. Mueller Co., West Cerro Gordo street, Decatur, Ill.

Trade Notes.

PAVING.

Oklahoma City, Okla.—The secretary of state has issued a charter to the Severens Paving Co. of this city, capital $30,000. The incorporators are: J. O. Severens, Charles T. Derr and Horace Hayden, Sr., all of Oklahoma City.

MACHINERY.

Fort Wayne, Ind.—Special—On June 1, 1911, the Fort Wayne Electric Works was merged with the General Electric Company of Schenectady, N. Y. Its business is now conducted under the name of Fort Wayne Electric Works of General Electric Company. All correspondence should be sent to the Fort Wayne Electric Works at the same address as in the past.

St. Louis, Mo.—Special—The City of Mansfield, Mass., has just now placed with the Busch-Sulzer Bros.-Diesel Engine Co. an order for an additional 225 horse power Diesel oil engine. This makes the fourth engine installed at the electric light plant of the city of Mansfield, Mass. The City of Granite Falls, Minn., has also placed an order for a 170 horse power engine as an auxiliary for water power in their electric light plant.

Canton, O.—The contract for furnishing two engines for city lighting plant was let to Russell Engine Co., of Massillon, O., $5,975; furnishing generator to Fort Wayne Electric Co., $4,640; furnishing 300 horse power boiler to Wick Boiler Co. of Detroit, $3,294.

Dallas, Tex.—Special—The board of city commissioners will purchase an air compressor to cost $780, two 75 horse power motors, three 50 horse power motors, and one 20 horse power motor.

Milwaukee, Wis—The contract for furnishing 300,000 gallons asphaltic street oil was let to the Indian Refining Co., New York City.

WATER.

MANSFIELD, Mass.—Special—A new corporation recently organized under the laws of the State of Massachusetts as the Langford Composite Pipe Co., of Mansfield, Mass., will manufacture a new type of concrete high pressure water pipe and service pipe under the patents of Mr. G. W. Priest, president of the new company. The pipe offers many advantages over ordinary pipe because of its greater carrying capacity, durability and proof against electrolysis and acids.

MISCELLANEOUS.

Muskogee, Okla.—Special—The secretary of state has issued a charter to the Yellowstone Construction Co. The capital is $25,000 and the directors are David Gunsburg and Ralph Hochsteder, both of Buffalo, N. Y.; H. G. Baker of Muskogee, Okla., and James Connolly of Titusville, Pa.

Philadelphia, Pa.—Special—The Sun Company, producers, refiners and exporters of petroleum products, have removed to the ninth floor of the Morris building.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Bloomfield, Ind.—July 5, 2 p. m. Constructing macadamized road in Jackson twp. C. H. Jennings, audt.

Bloomington, Ind.—July 5, 10 a. m. Constructing highway in Salt Creek twp. Horace Blakely, audt.

Booneville, Ind.—July 3, 2 p. m. Constructing various roads. N. M. Stradley, audt.

Brownstown, Ind.—July 5, 1:30 p. m. Constructing Medora rd. and Sparksville Hill rd. H. W. Wacker, audt.

Evansville, Ind.—July 6, 10 a. m. Constructing gravel road in Center twp. Chas. P. Beard, audt.

Franklin, Ind.—July 3, 1 p. m. Constructing gravel road in Union twp. W. B. Jennings, audt.

Frankfort, Ind.—July 6, 2 p. m. Constructing seven gravel roads. Charles F. Cromwell, audt.

Greenfield, Ind.—July 3, 10 a. m. Constructing roads in Sugar Creek twp. G. H. Troy, audt.

Indianapolis, Ind.—July 5, 10 a. m. Paving Hermann st. C. A. Schrader, pres. bd. of pub. wks.

Kentland, Ind.—July 6, 1 p. m. Constructing macadam roads in Iroquois twp., and stone roads in Grant and Jackson twps. E. R. Bringham, audt.

LaPorte, Ind.—July 3, 10 a. m. Constructing macadamized road in Scipio and Cass twps. F. A. Hausheer, audt.

Logansport, Ind.—July 5, 10 a. m. Constructing stone road in Boone twp. J. E. Wallace, audt.

Logansport, Ind.—July 6, 10 a. m. Constructing stone road in Deer Creek twp. J. E. Wallace, audt.

Monticello, Ind.—July 6, 12 m. Constructing stone road in Honey Creek twp. A. G. Fisher, audt.

Muncie, Ind.—July 5, 10 a. m. Constructing 2 roads. Francis M. Williams, audt.

Newport, Ind.—July 3, 10 a. m. Constructing gravel road in Holt twp. H. T. Payne, audt.

Petersburg, Ind.—July 5, 2 p. m. Constructing stone road in Patoka twp. John D. Gray, audt.

Portland, Ind.—July 3, 10 a. m. Constructing highway in Bear Creek twp. W. Lea Smith, audt.

Rockville, Ind.—July 10, 2 p. m. Constructing gravel roads in Jackson, Parke and Madison twps. J. E. Elder, audt.

Rushville, Ind.—July 5, 2 p. m. Constructing macadam road in Jackson twp. J. M. Stone, audt.

Salem, Ind.—July 3, 1:30 p. m. Constructing road in Brown twp. F. S. Munkelt, audt.

Sullivan, Ind.—July 5, 12 m. Constructing bituminous asphalt macadam road and a stone road. Ben C. Crowder, audt.

Valparaiso, Ind.—July 5, 12 m. Constructing four gravel roads. C. A. Blachly, audt.

Vernon, Ind.—July 3, 11 a. m. Constructing 3 mi. pike road in Bigger twp. M. W. Brogan, audt.

Versailles, Ind.—July 3, 1 p. m. Constructing macadam roads in Laughrey twp. Nicholas Volz, audt.

Wabash, Ind.—July 5, 1:30 p. m. Constructing 3 roads in Pawpaw twp., two in Noble twp., two in North Manchester, one between Noble and Waltz twps., and one between Noble and Pawpaw. J. P. Noftzger, audt.

Washington, Ind.—July 5, 10 a. m. Constructing gravel road in Washington twp. Thomas Nugent, audt

Williamsport, Ind.—July 3 3 p. m. Constructing highway in Mound twp. D. H. Moffett, audt.

Williamsport, Ind.—July 10, 2 p. m. Constructing gravel road in Adams twp. D. H. Moffett, audt.

Corning, Ia.—July 3, 7:30 p. m. Street improvements as follows: Curbing Davis ave., Eighth st., and other streets; paving various streets with brick and concrete, including 12,000 sq. yds. of brick pavement; 189 sq. yds. concrete pavement, and 2,373 lin. ft. curb and gutter. Certified check, $500. Wm. C. Chett, cy. clk. Theodore F. DeLay, engr.

Greenfield, Ia.—July 11, 2:30 p. m. Paving 14,000 sq. yds. with brick or cement concrete paving; 4,500 lin. ft. curb. Certified check, $1,000. Iowa Engineering Co., Chase blk., Clinton, Ia., engrs.

Westfield, N. J.—July 3, 8:15 p. m. Constructing 5,320 sq. yds. of 8-in. bituminous macadam; 5,500 lin. ft. of under drain and 155 lin. ft. concrete curb. Certified check, $500. Charles Clark, twn. clk.

Johnstown, N. Y.—July 3, 7:30 p. m. Constructing asphalt block pavement on South Ferry st., including 2,946 sq. yds. pavement and 1,244 lin. ft. of curb. Certified check, $500. Grover E. Yerdon, cy. clk.

Olean, N. Y.—July 5, 8 p. m. Constructing 9,800 sq. yds. wire cut lug brick pavement. John H. Gaynor, engr.

Wilmington, N. C.—July 15, 12 m. Constructing 24,000 sq. yds. pavement. Certified check, 5 per cent. C. Q. Moore, chrmn. com. on sts.

Brookville, O.—July 1. Paving Market st. Certified check, 5 per cent. H. E. Wheaton, clk.

Celina, O.—July 1, 10 a. m. Constructing road between Darke county and Mercer county. Certified check, $100. P. F. Blade, sur.

Cincinnati, O.—July 7, 12 m. Road improvement as follows: Specifications No. 229 for improvement on Sharon ave., certified check, $2,000; specifications No. 234, for improvement of Springfield rd., certified check, $2,000; specifications No. 232, oiling Carrolton pike, certified check, $500; specifications No. 203, for repairing various roads, certified check, $1,000. Fred Dreihs, clk. Hamilton co. com.

East Liverpool, O.—June 30, 12 m. Paving alley with vitrified brick, certified check, $500; paving Mulberry st. with vitrified brick, certified check, $500; grading Cadmus st., certified check, $500. B. V. Beattey, dir. of pub. ser.

Lakewood, O.—July 3, 12 m. Constructing delinquent sidewalks of stone, certified check, $200. B. M. Cook, clk.

Lisbon, O.—July 3, 9 a. m. Constructing Carpenter's Hollow rd., certified check, 50 per cent. Lura M. Kannel, clk.

Mt. Gilead, O.—July 7, 11 a. m. Paving improvements as follows: Kirk rd., certified check, $500; Mills, rd., certified check, $500; Osborn rd., certified check, $500; Clark and Purington rd., certified check, $500. Clifton Sipe, co. audt.

Ottawa, O.—July 7, 12 m. Constructing Troy co. rd. improvement No. 10, certified check, $500. Joseph Kersting, audt. of Putnam co., Ohio.

Bedford, Pa.—July 1, 10 a. m. Constructing public rd. Josiah R. Richey, sec. bd. of High Springs twp. superv.

Lancaster, Pa.—July 3, 9 a. m. Constructing concrete curb on E. Orange st., certified check, 15 per cent. H. Frank Ashleman, co. compt.

McKeesport, Pa.—July 6, 8 p. m. Paving Fourth ave., certified check, $200. J. O. Stance, chrmn. st. com.

Pittsburg, Pa.—July 5, 10 a. m. Road construction as follows: Buena Vista and Lovedale rd., 2 6-10 mi. of bitulithic; Squaw road, 1⅝ mi. of oiled macadam; Wilmerding rd., ⅞ mi. macadam; Cliff Mine and Coraopolis Heights rds, 4 8-10 mi. of macadam; Buiasuta rd., ⅝ mi. brick; Bakerstown rd., 1-3 mi. macadam; Bakerstown and Valencia extension No. 2, 1,500 ft. macadam. Robert J. Cunningham, co. audt.

Uniontown, Pa.—July 3. Building 10,700 ft. macadam road including all bridges and culverts. Roy W. Elliott, Jackson twp. suprv.

Wilson, Pa.—July 6, 8 p. m. Constructing pavement on Fourth ave., certified check, $200. J. O. Spence, chrmn. st. com.

Parkersburg, W. Va.—July 3, 12 m. Constructing brick pavement as follows: Williamstown rd, Dudley ave., Northwestern pike, Staunton pike, certified check, $2,500 on each bid. C. Skidmore Company, engrs. Wm. Dudley, clk.

CONTRACTS AWARDED.

Little Rock, Ark.—Constructing sidewalks and gutters in Spifft add., to Woodsmall & McCarty, $11,000.

San Francisco, Cal.—Constructing sidewalks, curb catch-basin on Boyce st., to the Federal Construction Co., San Francisco, Cal.

Ocean Park, Cal.—Paving Ocean ave., to Braun, Bryant &Austin; paving alley, to Chas. H. Mattern.

Bridgeport, Conn.—Paving Barnum ave., to W. H. Archur, Stamford, Conn.; furnishing block for same, to U. S. Wood Preserving Co., 165 Broadway, New Y ork.

Gilman, Ill.—Paving Central st., to G. W. Trutsman, Danville, Ill.

Moline, Ill.—Paving 4th ave. with brick, to Britt & Layden, $51,667.

Indianapolis, Ind.—Constructing pavement in alleys north of Vermont st., to American Construction Co., Indianapolis.

Logansport, Ind.—Contract for road improvement has been awarded to the following contractors: F. E. Barnard, Delphi, Ind.; George Emery, Galveston, Ind.; Fred P. Woods, Burnettsville, Ind.; Harry A. Barnes & Son, Logansport, Ind.

Michigan City, Ind.—Constructing macadam roads in Center and Springfield twps., to John A. Young, $18,420.

Harlan, Ia.—Paving Baldwin st., to G. Mancini, Florence, Neb., $15,666; constructing gutters, to Llana Construction Co., Harlan, $2,175; paving, to H. Atkinson, Watertown, S. D., $2,252. John P. Crick, Omaha, Neb., engr.

Washington, Ia.—Paving N. Iowa ave. with brick, to J. J. McKeon, Washington, Ia.

Topeka, Kans.—Constructing 200 sq. yds. pavement, to Luthyjohn & Foucht, $1,100.

Louisville, Ky.—Constructing vitrified block pavement to cost $56,000, to the following contractors: Henry Bickel Co,, and L. W. Hancock Co.

Holyoke, Mass.—Constructing retaining wall in Railroad st., to P. J. Kennedy, Jr., Holyoke, Mass., $11,720.

Uxbridge, Mass.—Constructing electric light plant addition to E. W. Ward & Co., Worcester, Mass.

Mankatopato, Minn.—Paving 16 blocks with creosoted wood block, to The North Star Concrete Co., Mankatopato, Minn.; paving 5 blocks with bituminous macadam, to Fowler & Pay, Mankatopato, Minn.

St. Joseph, Mo.—Paving Monterey st. with mineral rubber asphalt, to the Metropolitan Paving Co., St. Joseph, Mo.; grading Edmond st., to W. B. Kelly.

St. Louis, Mo.—The following paving contracts have been awarded: Benton st., to Parker-Washington Co., 4500 Duncan ave., $45,748; 25th st. with bitulithic, Granite Bituminous Paving Co., $34,734; Howard st. and 21st st. with asphalt, to G. A. Heman, $77.142.

Hastings, Neb.—Paving various streets, to M. Ford and E. R. Bing.

Atlantic City, N. J.—Paving Vermont ave., $109,218, and Congress ave., $1,311, to the United Paving Co., Bartlett bldg., Atlantic City, N. J.

Albany, N. Y.—Paving King ave., to John M. Holler, $12,275; paving Morris st., to Mulderry Bros.

Schenectady, N. Y.—The following paving contracts have been awarded: River road with sheet asphalt, to the Schenectady Construction Co.; paving River road with macadam, to same; DeGraf st. with brick, to Thomas R. Trane; Church st. with sheet asphalt, to the Schenectady Contracting Co.

Syracuse, N. Y.—The following st. improvement contracts have been awarded: Grading Oakland ave., to Anthony Sposato, $811; grading Greenway ave., to same, $9,692; grading Hawley ave., to Samuel Bann, $1,800.

Akron, O.—Constructing pavement on Cedar st., to E. McShaffery & Son.

Canton, O.—Paving 2½ mi., to Frank Downs, Canton, O., $29,397.

Canton, O.—Paving 2 mi. of road, to N. J. McGinty, of Minerva, O., $40, 820.

Canton, O.—The following paving contracts have been awarded to Piero and Palarico: Gibbs st., $17,678; S. Court st., $6,-672; Williams st., $6,518.

Canton, O.—Paving 1 mile of Lexington road, to John Wilson, Alliance, O., $17,607; constructing 1 mi. of Harrisburg road, to same, $18.448. Material to be used is brick on concrete foundation.

Chardon, O.—Paving South pike, to the Cement Products Co., Erie, Pa., $20,385.

Cincinnati, O.—Paving 5th st. and Madison st., to F. J. Ruh Co.

Cincinnati, O.—Improvement of Crookshank rd., to the Joseph Gradison Construction Co., Cincinnati, O., $15,986.

Dayton, O.—The following paving contracts have been awarded: Huffman ave., to J. E. Conley & Co., $40,482; macadamizing Cincinnati pike, to Gebhart & Kline, $10,242.

East Liverpool, O.—Paving contracts have been awarded as follows: Bradshaw ave., to Rinehart Bros; Elm st. and Sugar st., to Freshwater Bros.; St. Clair ave., to John McLaughlin; Virginia ave., to John Ryan & Son; Riley ave., to Rinehart Bros.

Findlay, O.—Paving Ash ave., to D. P. Hall & Sons.

Greenville, O.—The following road contracts have been let: The Duncan rd., to J. R. Smith, $5,890; material, to the Greenville Gravel Co., $4,490; the Monney rd., to F. A. Warner, $13,598; material, to Albert Shafer, $2,300; the W. R. Hittle rd., to Manning &

Walls, $3,483; material to the Greenville Gravel Co., $5,220; the Henelgarn rd., to J. F. Canelltern, $1,398; material, to the Greenville Gravel Co., $2,595.

Leetonia, O.—Paving Main and Chestnut sts., including 14,500 sq. yds. block pavement and 60,500 ft. of stone curbing, to J. G. Maguire & Co., New Brighton, Pa.

Liverpool, O.—The following paving contracts have been awarded: Thompson ave., Blakely, Vine and Fawcett sts., to Hinton & Cunningham, $13,000; E. 4th st. to Freshwater Bros., of Chester, O., $1,850; Railroad and Church sts., to Thomas McLaughlin, 7,500 and $4,900.

Lisbon, O.—Constructing McKinley ave., pavement, to Buell and Baker, of Salem, $7,513.

Montpelier, O.—Paving Empire and Main sts. H. S. Enck, Lima, O., $48,908.

Orrville, O.—Paving E. Main and S. Main st. in Wellington, to Lee & Greggs, of Millerburg, O., $35,000.

Palestine, O.—Paving various sts, to George Patterson, Wellsville, O., about $20,000.

Tiffin, O.—The following paving contracts have been awarded: LaBelle View blvd., to Floto Bros., $12,117; Church st., to John O. Bates, $464; Alley C, to same, $1,785; Railroad ave., to Floto Bros., $2,751.

Warren, O.—Constructing 5 mi. of brick highway, to the South Shore Construction Co., Erie, Pa., $80,000.

Franklin, Pa.—Constructing 13,178 ft. of brick rd., to J. E. Francis, Punxsutawney, Pa., $40,000.

Franklin, Pa.—Paving Liberty st., to the Northwestern Construction Co., Franklin, Pa., $1,768.

Johnsonburg, Pa.—Paving Center st., to Applegate & Co., $14,905.

McDonald, Pa.—Paving a number of sts, to Rosser & Maloney, Ballaire, O., $41,673.

McKeesport, Pa.—Constructing paving to cost $7,435, to Totley & Co.

Erie, Pa.—Paving 20th st., to J. & M. Doyle; paving E. Adams st., to Mayer Bros.

Newcastle, Pa.—Street improvement has been awarded to J. F. Summers & Son.

Pittsburg, Pa.—Paving Edwards alley, to J. B. Sheets Co., $2,159; constructing sidewalks, to E. L. Mahoney, $1,379.

Quakertown, Pa.—Macadamizing a number of streets, to Wm. P. Davis, of West Chester, Pa.

Reading, Pa.—Constructing vitrified pavement on Sixth st., to Fehr & O'Rourke, $13,166.

Dallas, Tex.—Paving Ross and Austin sts., to the Creosoted Wood Block Paving Company.

Salt Lake City, Utah.—Constructing sidewalks in extension No. 148, to McRae and Burt, $3,871.

Seattle, Wash.—Paving Lake View blvd., to P. J. McHugh, Third ave. and Mercer st., Seattle, $36,526.

Seattle, Wash.—The following paving contracts have been awarded: New 10th ave. grading, to Erickson Construction Co., Pioneer bldg., Seattle, $2,654; grading 63rd ave., southwest, to W. F. Manney & Co., $35,158.

Tacoma, Wash.—The following paving contracts have been awarded: Grading Madison, to Galluol & Berost, Portland, $5,973; paving Gar and other sts., to Keasal Construction Co., Providence bldg., $59,471; paving alley, to O. R. Robinson Co., 1322 S. Young, Yakama ave., $1,125.

Wheeling, W. Va.—Repaving alley C, to George Lemmon; paving 21st st., to same.

Milwaukee, Wis.—The following paving contracts have been awarded: North ave., 22,581 sq. yds. asphalt, to R. F. Conway Co., of Chicago, Ill.; Greenfield ave. with asphalt, to the Badger Construction Co., 1015 Railway Exchange bldg., Milwaukee, Wis.; Greenfield ave. between 11th ave. and Layton blvd., to R. F. Conway Co., Chicago, Ill.

CONTEMPLATED WORK.

Phoenix, Ariz.—The city is contemplating the construction of 25,000 sq. yds. of asphalt pavement.

Argenta, Ark.—The city is contemplating paving in districts 11 and 12. E. A. Kingsley, Little Rock, Ark., engr.

Albany, Ga.—A $12,500 bond issue for street paving has been voted.

Morrison, Ill.—The city is contemplating the following paving construction: 16,170 sq. yds. asphalt macadam; 3,520 sq. yds. brick, 10468 lin. ft. combined curb and gutter; 2,000 lin. ft. of curb. Edw. O. Hills, cy. engr.

Ft. Wayne, Ind.—Frank M. Randall, cy. engr., has prepared plans and estimates for the paving of Webster st.

Shenandoah, Ia.—The city is contemplating the paving of 24,000 sq. yds. with asphaltic concrete.

Rockville, Md.—A $12,000 bond issue for the construction of roads has been voted.

Royal Oak, Mich.—A $40,000 bond issue for macadamizing Woodward ave. has been voted.

Binghamton, N. Y.—The paving of Main st. is contemplated.

Mt. Vernon, N. Y.—A $58,000 bond issue for road improvements has been voted.

Kings Mountain, N. C.—A $25,000 bond issue for the construction of roads has been voted.

Wilmington, N. C.—A $50,000 bond issue for road and bridge improvements has been voted.

Findlay, O.—The paving of Main st., to cost $40,000, is contemplated.

Checotah, Okla.—City council will adopt plans and specifications for extensive paving work, after which bids will be received.

Tulsa, Okla.—This city is contemplating the paving of 80 blocks of streets, to cost about $80,000. Cy. Engr. Hughes.

Pawhuska, Okla.—City council has passed resolutions for the paving of a number of streets with Oklahoma asphalt.

Hillsboro, Ore.—The city is contemplating the paving of 11 blocks with bitulithic, and the construction of sanitary and storm sewers.

Philadelphia, Pa.—The following street improvements are contemplated: Repaving sts. now occupied by car track, $500,000; improving blvd. from 2nd st. to Rhawn, $500,000; repaving various sts. with wood block, $300,000; grading st., $150,000; improving South Broad st., $150,000; resurfacing and improving country road, $100,000.

Washington, Pa.—A $500,000 bond issue for the construction of 21 mi. of brick highway has been voted.

Wellsboro, Pa.—A $49,000 bond issue for brick paving has been voted.

Granger, Texas.—A $100,000 bond issue for macadamized road construction has been voted.

Liberty, Tex.—A $250,000 bond issue for road improvement has been voted.

Dayton, Wash.—The city is contemplating the paving of Main st. and portions of other streets. J. A. Muirhad, mayor.

SEWERS.

BIDS REQUESTED.

Aurora, Ill.—July 1, 2 p. m. Constructing 4 mi. vitrified pipe in district 7 and 4 mi. in district 8. Lyons Parvel, engr.

Valley Junction, Ia.—July 13, 7 p. m. Constructing 5½ mi. 8-in. to 20-in. pipe sewers and a sewage disposal plant, two

checks for $500 each. Iowa Engineering Company, engrs., Chase blk., Clinton, Ia.

Parsons, Kan.—July 3. Constructing septic tank and sewer system to cost between $55,000 and $75,000. C. B. J. Wheat, cy. clk.

Louisville, Ky.—July 7, 12 m. Constructing 5,245 ft. 10 to 22-in. vitrified pipe sewer, certified check, 7 per cent. E. L. Atherton, chrmn. com. of sew. J. P. F. Breed, chief engr.

Fitchburg, Mass.—July 11, 3 p. m. Constructing 2,928 ft. of 45-in. concrete sewer; 490 sq. yds. brick masonry invert, certified check, $2,500. David A. Hartwell, chief engr.

Vicksburg, Miss.—July 3, 8 p. m. Constructing storm sewers on Grove st., Belmont st. and Levee st. J. J. Hayes, mayor.

Duquesne, Pa.—July 1, 12 m. Constructing sewer in Center st. L. W. Francis, chrmn. of sewer com.

Madison, S. D.—July 6, 8 p. m. Sewer construction as follows: 1,500 ft. 18-in. vitrified pipe; 3,000 ft. 18-in. vitrified pipe; 2,700 ft. 15-in. vitrified pipe; 6,060 ft. 12-in. vitrified pipe; 3,325 ft. 10-in. vitrified pipe; 11,520 lin. ft. 8-in. vitrified pipe; 3,360 ft. 6-in. vitrified pipe; 80 manholes; and 5 flush tanks, certified check, $1,000. Geo. W. Waskey, may. Wm. Rae, cy. audt.

CONTRACTS AWARDED.

Oakland, Cal.—Constructing sewer on Lyons ave., to Wm. Heafey, $11,348.

Brazil, Ind.—Constructing Pogue's Run sewer, 4,000 ft. in length, to Campbell & Crabb.

Tolleston, Ind.—Sonstructing sewer system, to Michael Byrne, Gary, Ind., $165,000.

Mullan, Idaho.—Constructing sewerage system, to R. M. Bartson & Co., Butte, Mont., $15,760.

Clinton, Ia.—Constructing sewers in district No. 4, to W. Green & Son, of Appleton, Wis., $125,375. R. C. Hart, cy. engr.

Lexington, Ky.—Constructing sewers, to Joseph Melvin and Thomas O'Day.

Adams, Mass.—Constructing sewers, to J. E. Fitzgerald Co., of New London, Conn., $10,090.

St. Paul, Minn.—The following sewer contracts have been awarded: Eaton ave., to P. J. Ryan, $337; St. Clair st., to Christ Johnson, $1,486; Hathaway st., to A. Nelson, $1,210; Front st., to P. J. Ryan, $1,555; Jessie st., to O'Neil & Preston, $1,029.

St. Joseph, Mo.—Constructing sewers in district 72, to D. B. Kelley; in district 107, to John Marnell.

St. Joseph, Mo.—Constructing sewer in district No. 113, to E. F. Mignery.

Platte, Neb.—Constructing sewer in district A, to C. J. Burke & Son, of Kearney, Neb.

East Las Vegas, N. M.—Constructing sewer system, to Thomas McGovern and J. Ryan, Pueblo, Colo., $20,663.

Englewood, N. J.—Constructing sewerage disposal works, to the Atlantic Construction and Supply Co., Atlantic City, N. J., $16,-227.

Syracuse, N. Y.—The following sewer contracts have been awarded: Colvin st. trunk sewer extension, to Patrick R. Reily, $61,703; Lancaster ave., to James Swift, $2,449; Livingston ave., to same, $1,2223; Sumner ave. to Philip Thomas, $1,294; Ackerman ave., to same, $4,066.

Bellefontaine, O.—Constructing sewerage disposal plant, to Theodore W. Hill, of Bellefontaine, $26,000.

Lorain, O.—Constructing complete sewer system, to United States Construction Co., Columbus, O., $17,869; constructing disposal plant, to Seymour-Rennick, Findlay, O., $7,523 for two bed plant and $9,991 for three bed plant.

Xenia, O.—Constructing sewerage plant in county institution, to Huonker & Williams, Springfield, O., $2,800.

Youngstown, O.—Constructing main trunk sewer, to John Grady, $40,000.

Arnold, Pa.—Constructing sewage disposal plant, to Tony Martin, of Tarentum, Pa., $50,000.

Erie, Pa.—Constructing sewers on 4 streets, to Clement Wolfran; constructing sewer on 1 street, to John McCormick & Son.

Newcastle, Pa.—Sewer construction has been awarded to the following contractors: F. M. Mayburk, Burns Bros. and Chas. Stapf.

Philadelphia, Pa.—The following sewer contracts have been awarded: Constructing inlets, to Wm. A. Ryan and Frederick Buckrus, $25,000; constructing bank sewers, to cost $175,000, to the following: Donati Delife, Joseph Perna, David McMahon, Vincent Jasolla, Joseph Conkling, Wm. A. Ryan, Emilie Pastuzzi, Patrick Durkin, Peter Ellis, Alphonso Perna, Joseph Lombardi, Richard Bennis, John A. Robb, Joseph Moss, Nicholas Cannol and John T. Connor.

Pittsburg, Pa.—The fololwing sewer contracts have been awarded: Forty-third st., to M. O'Herron Co., $1,752; Edwards alley, to J. B. Sheets Co., $713; the Lamasco drive, to Ott Bros., $448.

Sweetwater, Tenn.—Constructing complete sewerage system, to M. A. Joy, Terrell, Tex.

Seattle, Wash.—Constructing north trunk sewer in Interbay district, to Colson Construction Co., Alaska bldg., Seattle, Wash., $925,784.

Seattle, Wash.—The following sewer contracts have been awarded: N. 55th st., to Kroth and Jessen, 4011 Greenwood ave., Seattle, $13,381; N. 59th st. sewer, to same, $36,515.

Seattle, Wash.—Constructing sewers on 5th ave., to Nelson & Carlson.

Antigo, Wis.—Constructing sewerage disposal plant, to the John Borgan, of Green Bay, Wis., $90,945; constructing sewer, to same, $419,889.

CONTEMPLATED WORK.

Ozark, Ala.—A $15,000 bond issue for sewer construction has been voted.

Washington, D. C.—An American consul officer reports that a city in his district is contemplating the installation of a sewerage system. Address Bureau of Manufacturers, No. 6834.

St. Petersburg, Fla.—The city is contemplating the construction of a sewerage disposal plant. N. W. Spencer, cy. engr.

Albany, Ga.—A $12,500 bond issue for sewerage improvement has been voted.

Atlanta, Ga.—The J. B. McCrary Co., Empire bldg., Atlanta, Ga., has been retained to prepare plans for sewer improvement in the cities of Lavonia, Callatoosa and Winder. Ga.

Savannah, Ga.—John W. Howard is preparing plans for storm water drainage system extension.

Quincy, Ill.—The city is contemplating the construction of a sanitary sewer system in the south part of the city.

Valley Junction, Ia.—The city is contemplating the purchase of 7 mis. of sanitary sewers and a disposal plant to cost about $40,000. Iowa Engineering Co., Clinton, Ia., engrs.

Mulvane, Kans.—The city is contemplating the construction of a sewerage system to cost $6,000.

Morgan City, La.—K. A. Kramer, Magnolia, Miss., has been retained to make a survey for sewerage and water works system, to cost about $60,000.

Wymore, Neb.—C. H. Meeker is preparing plans and estimates for a complete sewer system for the city.

Albany, N. Y.—Rudolph Hering, 170

Broadway, New York, has been retained to prepare plans for proposed intercepting sewer.

Clinton, N. C.—A $30,000 bond issue for sewer and water works has been voted.

Bismark, N. D.—The city is contemplating the construction of a new sewer system.

Youngstown, O.—The city is contemplating the construction of a sewer in Rayen ave.

Edmond, Okla.—A $20,000 bond issue for the extension of water works system, sewers and improvement of the municipal electric light plant has been voted.

Oklahoma City, Okla.—The city is contemplating the construction of an electrolithic sewerage purification plant to dispose of the sewage from the Packingtown sewer, to cost about $25,000.

Tulsa, Okla.—City Engineer Hughes has presented plans and estimates for sewer improvements to cost $20,697.

Ligonier, Pa.—The city is contemplating the construction of a sewerage disposal plant and pumping station. F. H. Shaw, Lancaster, Pa., engr. Ira Brant, cy. clk.

Philadelphia, Pa.—A $50,000 bond issue for construction of Conockfink creek sewer and $160,000 for construction of main sewers has been voted.

Leola, S. D.—This city is contemplating the installation of a sewerage system to cost $4,043.

Knoxville, Tenn.—City council has rejected all bids on sewer extension work. New bids will be asked. Work is contemplated to cost $3,000.

Mount Pleasant, Tex.—A $16,000 bond issue for sewer improvements has been voted.

Ronceverte, W. Va.—A $16,000 bond issue for sewer improvements has been voted.

Mariette, Wis.—A $9,000 bond issue for sewer extension has been voted. J. L. Fisher, may.

WATER WORKS.

BIDS REQUESTED.

Macon, Ga.—July 16, 12 m. Furnishing and laying 5,000 ft. 12-in. pipe; 3,140 ft. 8-in. pipe; 5,363 ft. 6-in. pipe with all appurtenances, certified check, $500. John T. Moore, may.

Homewood, Cook Co., Ill.—July 1, 8 p. m. Furnishing a connected system of 6 to 10-in. cast iron water supply pipe, power hydrant, gate valve, valve boxes and specials, certified check, 10 per cent. Howard Harwood, sec. bd. of loc. imp. O. F. Reich, bor. atty.

Camden, N. J.—July 10, 11 a. m. Furnishing the following equipment for water works plant, power house, gasoline engine, with all connections, generator and complete electrical equipment. Samuel Wood, chrmn.

McAlester, Okla.—The city is advertising for bids on one Duplex pump and 40,000 ft. of 8-in. cast iron pipe for water works system.

Salt Lake City, Utah.—June 30, 8 p. m. Constructing waterways on various streets. H. G. McMillan, chrmn. bd. of pub. wks.

Seattle, Wash.—July 7, 10 a. m. Constructing steel pipe line for Cedar river water supply system No. 2, sertified check, 5 pe rcent. P. E. Bagley, sec. bd. of pub. wks.

Montreal, Can.—July 13, 12 m. Constructing final filters and appurtenances for city filtration plant, certified check, $65,000. L. N. Senecal, sec. bd. of com.

Brisbane, Queensland, Australia.—Jan. 30, 1912, 12 m. Furnishing the following water works supplies: 2 and 3 complete units, consisting of power generating plant or plants and pump or pumps of ample power and capacity to raise from the suction wells through the delivery mains through a total vertical lift of 400 ft. exclusive of the head due to friction, etc., not less than 6,000,000 British Imperial gal. of a volume each gal. of 277.463 cu. in. per unit plant per day of 24 hours. George Johnson, sec.

CONTRACTS AWARDED.

Colorado Springs, Colo.—Laying water mains, to J. S. Schwartz, of Colorado Springs; furnishing materials, to J. A. Clow & Sons, of Chicago, and Hendrie & Bolthoff, Denver, and the American Cast Iron Pipe Co., of Kansas City. C. B. McReynolds, water supt.

Marquette, Mich.—Constructing water works extension, to Wamless & Cling, Duluth, Minn., $60,000.

Kansas City, Mo.—Constructing a building for city hypochlorite plant at Quindaro, to Flanagan Bros., $7,100.

Glen Ridge, N. J.—The city has purchased the water works plant and all equipment of the Orange Water Co., $40,000

Sapulpa, Okla.—Constructing tank and 4 mi. pipe line for city water supply, to P. J. McNerney, Carthage, Mo., $120,000.

Sapulpa, Okla.—Constructing water works system to cost $230,000, to the Southwestern Engineering Co., Oklahoma City.

Willamina, Ore.—Constructing water works system complete, to Jacobsen-Bade, Portland, Ore.

Masontown, Pa.—Constructing filtration plant, to the Pitt Construction Co., Pittsburg, Pa.

Springdale, Pa.—Constructing 35,666 lineal ft. cast iron water pipe and 350,000 gallon reservoir, to McGlathery & Robb, Philadelphia, Pa., $17,993.

Seattle, Wash.—Constructing pen stock for Lake Union plant, to Jahn Construction Co., Empire bldg., Seattle, $31,489.

Milwaukee, Wis.—Extending high water service, to Edw. O'Donnell.

CONTEMPLATED WORK.

Oakdale, Cal.—An $82,000 bond issue for water works improvement has been voted.

East Peoria, Ill.—The city is contemplating the installation of a gravity water works system.

Moline, Ill.—The city is contemplating the erection of 350,000-gal. stand pipe. Grant Fair, chrmn. of com.

Augusta, Kan.—The city is contemplating the construction of a filtration plant to cost $4,000.

Coffeyville, Kan.—The city is contemplating water works improvements to cost $100,000, including filter plant and service main. Charles Stromquist, supt.

Morgan City, La.—K. A. Kramer, Magnolia, Miss., has been retained to make a survey for sewerage and water works system, to cost about $60,000.

Franklin, Mass.—A $50,000 bond issue for water works improvement has been voted.

Millard, Neb.—A $10,000 bond issue for water works improvements has been voted.

Charlestown, N. H.—The city is contemplating the construction of a small gravity water system for North Charlestown. Dudley & Sawyer, Lancaster, N. H., engrs.

New York, N. Y.—The aldermen have appropriated $8,690,000 for filtration plant at Jerome Park reservoir for Croton water supply.

Clinton, N. C.—A $30,000 bond issue for sewer and water works has been voted.

Old Harbor, O.—A $31,000 water works system is contemplated.

Van Wert, O.—A. L. Metheany, Lima, O., has been instructed to prepare plans and specifications for complete water works system.

Bennington, Okla.—City council has passed a resolution ordering that construction of a water works system to cost $20,000. The engineer has not been named.

Edmond, Okla.—A $20,000 bond issue for the extension of water works system, sewers and improvement of the municipal electric light plant has been voted.

Oklahoma City, Okla.—Local engineers are preparing plans for enlarging dams in the Canadian river for temporary water supply.

Marshfield, Ore.—The city is contemplating the construction of a joint water system with North Bend, Ore.

Glasgow, Pa.—The city is contemplating the construction of a water works system. Henry Camp, pres. coun.

Glen Rock, Pa.—The city is contemplating water works improvements. Jacob H. Brillhart, 34 N. 7th ave., Bethlehem, Pa., engr.

Huntington, Pa.—A new reservoir will be constructed by the Huntington water works company. Wm. Walker, pres.

Greenville, Tenn.—A $60,000 bond issue for water works and electric light improvement has been voted.

Price, Utah.—A $9,000 bond issue for water works extension has been voted.

Ellensburg, Wash.—Plans have been completed for the construction of water works system, including 16-in. pipe line and 1,000,000-gal. reservoir. E. M. Miller, engr.

Snohomish, Wash.—A $110,000 bond issue for the construction of a water works system has been voted.

BRIDGES.

BIDS REQUESTED.

Santa Barbara, Cal.—July 5. Constructing Thomas 3-hinge reinforced concrete bridge with 5-arch spans 126 ft. each. Estimated cost, $50,000. Frank Flourney, Santa Barbara Co., engr. Thomas & Post, Los Angeles, Cal., engrs.

Columbus, Ind.—July 5. Constructing several bridges. P. J. Sater, audt.

Bloomfield, Ind.—July 5, 2 p. m. Constructing bridge in Taylor twp. C. H. Jennings, audt.

Frankfort, Ind.—July 5, 2 p. m. Constructing 4 new bridges and repairing 12. C. M. Cromwell, audt.

LaPorte, Ind.—July 3, 10 a. m. Constructing several bridges. F. A. Hausheer, audt.

LaPorte, Ind.—July 6, 10 a. m. Constructing a number of bridges. Fred A. Hausheer, audt.

Richmond, Ind.—July 8, 11 a. m. Constructing 24-ft. span concrete bridge in Greene twp.; constructing 18-ft. concrete bridge on the Cart rd.; constructing concrete core and canal bridge. Demas S. Poe, audt. of Wayne co .

Rockville, Ind.—July 5, 1:30 p. m. Constructing several bridges. J. E. Elder, audt.

Mayersville, Miss.—July 3, 12 m. Constructing draw spans in all bridges in Issaquena co. M. M. Spiars, co. clk.

Friars Point, Miss.—July 3, 2 p. m. Constructing concrete or steel bridge. F. Parr, clk.

Vicksburg, Miss.—J uly 7, 12 m. Repairing Fisher's Ferry bridge. J. B. Laughlin, co. clk., Warren co.

Cincinnati, O.—July 7, 12 m. Constructing concrete bridge at intersection of German and Compton rds., certified check, $500. Fred Dreihs, pres. bd. of Hamilton co. com.

Cleveland, O.—July 12, 11 a. m. Constructing concrete bridge at North Woodland rd. John F. Goldenbogen, clk.

Harrisburg, Pa.—July 3, 12 m. Repairing two bridges, certified check, 10 per cent. B. F. Lebo, clk. co. com.

Houston, Tex.—July 3, 12 m. Constructing reinforced concrete viaduct over Houston ship canal, certified check, $20,000. D. Rice, may. W. L. Dormant, cy. engr.

CONTRACTS AWARDED.

Florence, Ala.—Constructing steel bridge over Elk river, to Austin Bros., Atlanta, Ga., $20,000.

Midvale, Ida.—Constructing steel bridge over Weimer river, to J. H. Forbes & Co., $11,495.

Goshen, Ind.—Constructing North Main st. bridge, to Elkhart Iron & Bridge Co., $5,277; constructing Lincoln avenue bridge, to Enrique Price, $1,150; constructing Wilden ave. and Northern Indiana ave. bridges, to Joseph Hess.

New York, N. Y.—Strengthening Williamsburg bridge, to Snare & Triest Co., $559,540.

Charlotte, N. C.—Constructing steel bridge over the Catawba river, to the Roanoke Bridge Co., of Roanoke, Va., $51,015.

Canton, O.—Constructing culvert, to John Wilson, of Alliance, O.

Hamilton, O.—Bridge contracts have been awarded to the following, all of Hamilton: John Golden, Joseph Westifer, George Emmons, Garver Contracting and Transfer Co., Jacoby & Lebaney Lumber Co., and J. T. Gullaume.

Hamilton, O.—Small bridge contracts have been awarded to the following, all of Hamilton: J. T. Guillaume, Horace Shield, Ohio Corrugated Culvert Co. and Geo. Emmons.

Middletown, O.—Contracts have been awarded as follows: Ohio Corrugated Culvert Co., $143; J. T. Guillune, $229; D. E. Snider, $9,081; Wm. Fogarty, $133; John Conrad, $124; J. T. Gillune, $174.

Oklahoma City, Okla.—Constructing 5 new bridges, to the Kansas City Bridge Co., Kansas City, Mo.

Scranton, Pa.—Constructing concrete bridge over Keyfer creek, to McLaughlin & Dingleberry, $995.

Ripley, Tenn.—Constructing 8 bridges, to the Joliet Bridge & Iron Co., of Joliet, Ill., $4,800.

Ft. Worth, Tex.—Constructing 60-ft. concrete bridge, to Dennis Sagan, $8,000.

Hallettsville, Tex.—Constructing bridge over South Mustang creek, to the Penn Bridge Co., Dallas, Tex., $1,030.

Richardson, Tex.—Constructing 70-ft. field span bridge, to the Missouri Valley Bridge & Iron Co., of Dallas, Tex.

Petersburg, Va.—Constructing bridge over Appomattox river, to the Virginia Bridge Co., Roanoke, Va.

Richmond, Va.—Constructing 118 ft. concrete bridge, to Owego Bridge Co., Owego,

CONTEMPLATED WORK.

New Haven, Conn.—Fredrick L. Olmstead, Boston, Mass., is preparing plans for a stone arch bridge at Edgewood Park to cost $7,000.

Indainapolis, Ind.—The city council has agreed to pay a sum not to exceed $10,000 to be added to the $70,000 appropriated by the county for the construction of the Capitol avenue bridge.

Michigan City, Ind.—The county is contemplating the construction of a 125-ft. bridge over Kankakee river to cost about $6,000.

Albert Lea, Minn.—The city is contemplating the construction of an 80-ft. concrete bridge to cost about $20,000. Wm. Barnuck, cy. engr.

New York, N. Y.—The construction of a
Red Lion, Pa.—The city is contemplating
templated.
the construction of a steel bridge on Charles st., over the tracks of the Maryland and Pennsylvania R. R.

STREET LIGHTING.

CONTRACTS AWARDED.

East Liverpool, O.—Furnishing complete electrical outfit for Oak Grove camp ground, to the Risinger Mfg. Co., 5th st., East Liverpool, O.

Bartlesville, Okla.—The Bartlesville Light & Power Co. has been sold to Ira L. Kobe, of Chicago, Ill.

Lancaster, Pa.—Lighting city for period of 5 years, to Edison Electric Light Co., at $65.75 per light per year.

Walla Walla, Wash.—The City Power and Light Co. has purchased the plant of the Waitsburg Electric Light Co., Walla Walla, $45,000.

CONTEMPLATED WORK.

Headland, Ala.—A $7,500 bond issue for the electric light extensions has been voted.

Albany, Ga.—A $50,000 bond issue for a municipal gas plant has been voted.

Blackshear, Ga.—The city is contemplating the purchase of a municipal light plant.

Hope, Idaho.—A franchise has been granted to the Northern Idaho & Montana Power Co. for lighting sts.

Fort Wayne, Ind.—The city is contemplating the installation of the ornamental street lighting system on several streets.

Dallas Center, Ia.—The city is contemplating the construction of an electric light plant.

Kansas City, Kans.—City has sold $35,000 bonds for municipal electric light plant to the Commerce Trust Co.

Boston, Mass.—The city council has appropriated $300,000 for the purchase of gas street lamps with automatic devices for lighting.

Billings, Mont.—The installation of ornamental lighting system is contemplated.

Rockville Center, L. I., N. Y.—An $11,000 bond issue for the construction of an electric lighting plant has been voted. S. G. Hooley, vil. atty.

Elmore, O.—A $5,000 bond issue for electric lighting system has been voted.

Edmond, Okla.—A $20,000 bond issue for the extension of water works system, sewers and improvement of municipal electric light plant has been voted.

Shawnee, Okla.—The plant of the Shawnee Gas & Electric Co. has been destroyed by fire. H. M. Bylesby & Co., of Chicago, Ill., will rebuild soon.

Oakland, Ore.—A $15,000 bond issue for the construction of light and power plant has been voted.

Beaver Falls, Pa.—The merchants on 7th ave. have decided to install ornamental lighting system.

Pittsburg, Pa.—The city is contemplating the extension of the ornamental lighting system to the following streets: Penn ave., 5th ave., Wood st. and Smithfield st. Joseph D. Armstrong, dir. of pub. safety.

Edgefield, S. C.—A $15,000 bond issue for an electric lighting system has been voted.

Greenville, Tenn.—A $60,000 bond issue for water works and electric light improvement has been voted.

Moosejaw, Sask., Can.—The city is contemplating the construction of a $35,000 lighting system, and ornamental lights to cost $7,500.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

Erie, Pa.—July 3. Constructing garbage incinerator plane for the city of Erie, certified check, 10 per cent. B. F. Briggs, cy. engr.

CONTEMPLATED WORK.

Boston, Mass.—All bids for disposal of city garbage have been rejected and new proposals will be asked.

Passaic, N. J.—The city is contemplating the construction of a complete garbage disposal plant. J. F. Featherstone, New York, engr.

Paterson, N. J.—This city is contemplating the construction of a garbage disposal plant to cost about $60,000. William F. Morse, New York City, engr.

Oklahoma City, Okla.—The city is contemplating the construction of a garbage disposal plant. Address, J. P. Highley, com. of pub. safety.

Newcastle, Pa.—The city is contemplating the enlargement of the garbage disposal plant. Address, Councilman Raney.

St. Johns, N. B., Can.—The city is contemplating the construction of a garbage disposal plant to cost about $50,000. Wm. Murdock, engr.

FIRE APPARATUS.

CONTEMPLATED WORK.

Little Rock, Ark.—The city is contemplating the purchase of an auto combination hose wagon; a first sized fire engine; a chief's auto; and a 75 ft. quick raising aerial truck.

Washington, D. C.—An American consul in Canada reports that a town in his district desires information and prices on a combination hose and ladder truck, auto propelled. Address Bureau of Manufacturers 6879.

Miami, Fla.—The city is contemplating the purchase of an auto truck.

Evanston, Ill.—The purchase of a motor fire engine with chemical tank is contemplated.

Decatur, Ind.—The city is contemplating the erection of a city hall and fire department building to be equipped with automobile apparatus.

Pikesville, Md.—Thr city is contemplating the purchase of an auto truck. Jacob H. Trask.

Lawrence, Mass.—The city is contemplating the purchase of an auto combination fire wagon.

Springfield, Mass.—City is contemplating the purchase of an auto squad wagon. J. B. Cadle.

Springfield, Mo.—Chief McLaughlin has recommended the purchase of 2 auto-propelled chemical engines.

Butte, Mont.—The city is contemplating the purchase of an auto and an aerial truck. Peter Sanger, chief.

Morristown, N. J.—The city is contemplating the purchase of an auto fire truck to cost about $6,000.

Niagara Falls, N. Y.—The city has voted $42,000 for the purchase of two fire houses and three pieces of automobile apparatus. David Isaacs, fire comr.

Yonkers, N. Y.—The ctiy is contemplating the purchase of three automobiles for fire department, to cost about $1,500.

Baker, Ore.—The city is contemplating the purchase of an auto-propelled fire engine. D. L. Palmer, mayor.

Providence, R. I.—The city is contemplating the purchase of 4 motor-driven combination wagons for the fire department, to cost about $20,000.

Clinton, S. C.—The city is contemplating the purchase of additional fire equipment. Address J. W. Cooper, chf.

Montpelier, Vt.—The city is contemplating the purchase of an auto propelled chemical engine.

Norfolk, Va.—This city is contemplating the purchase of motor fire equipment.